Draft Interim All Hazards Receipt Facility Protocol Standard Operating Procedures (Guidance)

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1.0 Scope and Application

The U.S. Department of Homeland Security (DHS), U.S. Environmental Protection Agency (USEPA), U.S. Department of Defense (DOD), Federal Bureau of Investigation (FBI), and The Association of Public Health Laboratories (APHL) have combined efforts to develop, construct, and implement the All Hazards Receipt Facilities (AHRFs) for prescreening unknown and potentially hazardous samples collected under unusual or suspicious circumstances. The effort was initiated in response to concerns from states and Federal agencies, particularly public health and environmental laboratories, for standardized guidance on screening samples to protect laboratories and ensure sample integrity and the validity of analytical results. This protocol is to be used as guidance. Implementation of this guidance may vary from one location to the next depending on the capabilities of the laboratory to which the All Hazards Receipt Facility (AHRF) unit is attached. The AHRF and the protocol should be adjusted to conform to the capabilities and goals of the particular facility.

Suspicious materials often generate a public safety/law enforcement response to determine whether the materials represent a risk to the general public or to the environment. It is important that these materials be screened in the field to determine if, indeed, they pose an imminent threat and therefore require special handling and transportation. For this reason, field screening procedures should include protocols for detecting potentially explosive devices and materials; radiological, flammable, and corrosive materials; and chemical or biological agents.

It is not unusual, however, for suspicious materials to be collected and transported directly to a laboratory without having been properly screened for hazardous materials. Moreover, it is often the case that laboratories are presented samples by individuals or groups where the laboratory has no reliable information on the capability of that group to perform adequate field screening. It is these situations that have led to requests for an AHRF where such unknown materials can be received and screened for categories of risk agents. All samples must be deemed a legitimate potential threat by local, state, or Federal law enforcement before the samples are accepted at the AHRF. Samples brought to a facility by citizen “walk-ins” must first be evaluated by a responsible government entity (e.g., state or federal emergency response team) prior to being accepted at the AHRF.

Samples of hazardous materials might become evidence in criminal investigations. The evidentiary nature of the unknown sample and the chain of custody (COC) must be preserved at all times. If possible photograph sample at every stage of the screening process to document it visually. Supplemental documentation (e.g., what was sampled, who performed any sample screening, the procedures used, and the results) should accompany the material. Samples also must be stored in a locked, limited access container or area when not in the custody of the person or persons responsible to preserve the COC. If the unknown material is likely dangerous, inform the local FBI Weapons of Mass Destruction (WMD) Coordinator immediately and other appropriate local authorities. If the sample is considered unlikely to be dangerous, a courtesy call informing the local FBI WMD coordinator of the sample is still recommended.

AHRFs are intended for in-process screening of unknown samples for chemical, explosive, and radiological hazards and to mitigate those hazards to protect laboratory workers and facilities

from contamination and injury. The current screening does not include biological screening, but will direct a suspected biological sample to an appropriate receiving laboratory. The facilities will be used on an "as needed" basis when field screening is not feasible or is insufficient to provide adequate information to protect the laboratory infrastructure. The AHRFs will not provide detailed or quantitative analytical results, but instead will provide initial screening of samples to determine whether a specific laboratory needs to be used for further examination of the evidentiary material. This document presents the draft interim AHRF Protocol and Standard Operating Procedures (SOP) for sample screening to be used as guidance when dealing with these types of scenarios. Figure 1 summarizes the proposed screening process.

It is assumed that facility staff will be trained in Occupational Safety and Health Administration (OSHA) requirements for hazardous waste operations and emergency response, standard 29 CFR 1910.120 or 29 CFR 1926.65, and will be familiar with a Health and Safety Plan specific to the facility. Some information and guidance regarding personal protective equipment (PPE) is provided in Attachment 1 of this document. OSHA requires that Level D protection is used when the atmosphere contains no known hazard, and work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous levels of any chemicals. Although Level D lists the use of hard hats and face shields, it is anticipated that these will not be needed during routine facility operations. The type of PPE should be assessed and modified as necessary with each sample received. At a minimum, PPE for AHRF staff should include the following:

- Coveralls or Laboratory Coat
- 2 pairs of nitrile gloves (e.g., nitrile gloves compliant with 21 CFR, preferably at least 5 mil). Alternatively, and if CWAs are suspected to be present in a sample, 1 pair of non-standard butyl gloves should be used as outer gloves worn over a double pair of nitrile gloves.
- Boots/shoes (chemical-resistant, steel toe and shank, and disposable outer boot/shoe covers)
- Safety glasses or chemical splash goggles (e.g., ANSI Z87.1-1989, SEI certified eye protection goggles or visor)
- Escape mask - close at hand

It is also assumed that facility staff will be familiar with the U.S. Department of Transportation Hazardous Materials Transportation Act (HMTA) and Hazardous Materials Transportation Safety Act (HMTSA) requirements at 49 CFR parts 171 through 177 for packaging and transporting hazardous materials. The screening process and results will be documented and recorded on COC forms, sample receipt forms, and screening results forms. Examples of these forms are provided in Attachments 2, 3, and 4, respectively.

The types of compounds targeted by the AHRF equipment included in this protocol are listed in Table 1 below. A list of the specific compounds that can be targeted by available screening equipment is provided in Table 2. ***This draft interim protocol currently does not include biological screening. The DHS and DOD are assessing potential "low tech" and low cost biological screening methods that may be added at a later date.***

Table 1. Classes of Compounds Targeted by the AHRF Screening Equipment

ALL HAZARDS RECEIPT FACILITY SCREENING EQUIPMENT		TARGET ANALYTES
TRANSPORT CONTAINER SCREEN		
Radiological Screen	Micro R Meter gamma scintillator	• Gamma Ray Emission
	Alpha, beta, gamma scintillator with data logger	• Alpha and Beta particles
Chemical Screen	Wipe with M8 paper if any unusual contamination is visible	• Nerve agents (GA, GB, GD, VX) • Blister agents (H, HD, HN, HT and Lewisite) • Any organic liquid
Primary Sample Container Screen (In fume hood or equivalent)		
Radiological Screen	Same as Above	• Same as Above
Explosives Screen	Colorimetric Indicator	• Nitro aromatics, nitrate-esters, nitramines, inorganic nitrate compounds, chlorates, peroxides (NOTE: See full list of explosive compounds in Table 2 for specific explosives targeted)
Chemical Screen	Flame Spectrophotometer (FSP) - optional	• Compounds containing phosphorous or sulfur • Nerve agents (GA, GB, GD, VX) • Blister agents (H, HD, HN, HT and Lewisite)
	Ion Mobility Spectrometer (IMS) - optional	• Nerve agents (GA, GB, GD, VX) • Blister agents (HD, HN, Lewisite)
	M8 Paper	• Nerve agents (GA, GB, GD, VX) • Blister agents (H, HD, HN, HT and Lewisite) • Any organic liquid

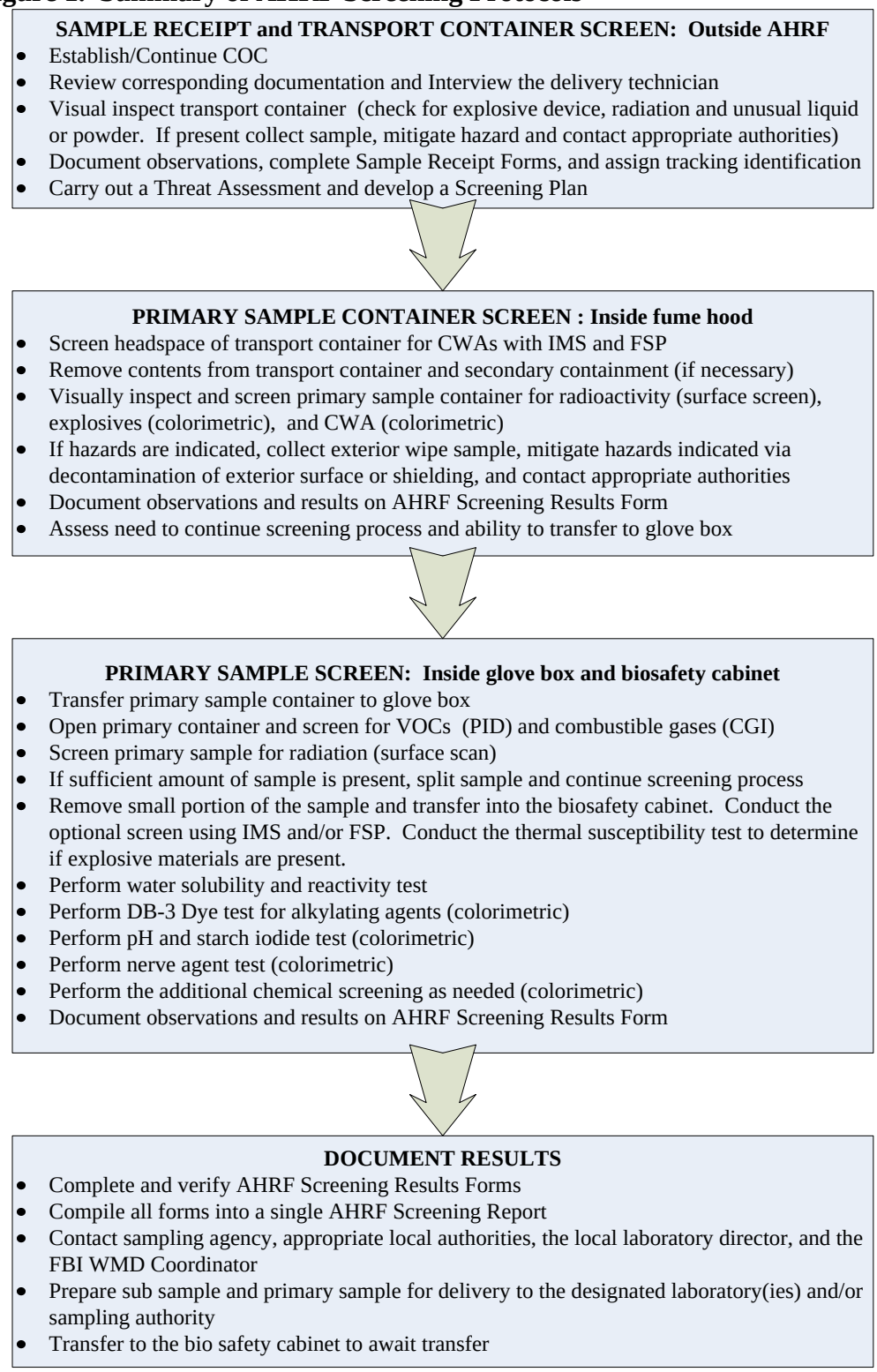
Primary Sample Screen (In glovebox)		
Radiological Screen	Alpha, beta scintillator with data logger	• Alpha and Beta particles
Explosives Screen	Thermal susceptibility test (to be performed in the biosafety cabinet outside of the glove box)	• Explosive materials • Energetic materials
Chemical Screen	Photoionization Detector (PID) and Combustible Gas Indicator (CGI)	• Most volatile organic compounds (VOCs). Device does not identify or distinguish between VOCs. • Nerve agents (GA, GB, GD, VX) • Blood agents (CK, AC) • Blister agents (H, HD, HN, HT and Lewisite) • Choking agents (CG)
	pH Paper Starch Iodide Paper	• Water miscibility/solubility • Acidity • Oxidizers
	Colorimetric enzyme test CWA (nerve agent) detection kit	• Nerve agents (GA, GB, GD, VX)

Table 2. Specific Compounds Targeted by the AHRF Screening Equipment

Chemical Warfare Agents	**Explosive Agents**
Nerve:	Ammonium nitrate
GA - Tabun	Barium nitrate
GB - Sarin	Black Powder
GD - Soman	Bromides
Organophosphate nerve agents	DNT - Dinitrotoluene
VX	EGDN - Ethylene glycol dinitrate
	HMTD - Hexamethylenetriperoxidediamine
Blister:	HMX - Octogen
H - Mustard agents	Lead styphnate
HD - Distilled mustard	Nitro cellulose
HN - Nitrogen mustard	Nitro glycerin
HT - Sulfur mustard	PETN - Pentaerythritol tetranitrate
Lewisite	Picric acid
	Potassium chlorate
Blood:	Potassium nitrate
AC - Hydrogen cyanide	RDX - Cyclonite
CK - Cyanogen chloride	Semtex
	Smokeless powder
Choking:	Sodium chlorate
CG - Phosgene	Sodium nitrate
	TATP - Triacetone-triperoxide
Chemical compounds	Tetryl
Arsine	TNB - Trinitrobenzene
Arsenic	TNT - Trinitrotoluene
Chlorine	Tri nitro naphthalene
Cyanide	
Fluoride	**Radiological Agents**
Hydrocyanic acid	Alpha and Beta particles
Hydrogen sulfide	Neutrons
Oxidizers	Gamma ray emission

If screening tests indicate the presence of an explosive substance or device, radioactive material, or a chemical warfare agent the local FBI WMD Coordinator and appropriate local authorities and experts shall be consulted. This protocol does not include recommendations regarding which analyses should be performed on the sample after it has gone through the AHRF screening process. If the AHRF procedures do not detect a hazard, it does not necessarily mean that hazardous material is not present at any quantity. The laboratory director is the final authority as to whether a sample can enter the laboratory. Many chemical, radiological, and explosive hazards to a laboratory also can be avoided if the AHRF sends only a small quantity of the sample to the laboratory. For example, if a sample is suspected to contain a chemical, radiological, or explosive hazard, the laboratory manager may agree to accept a sample size of no more than a swab, 500 mg and/or 0.5 mL. This would be appropriate only for certain analyses where only a small amount sample is needed (e.g., some biological screens).

Figure 1. Summary of AHRF Screening Protocols

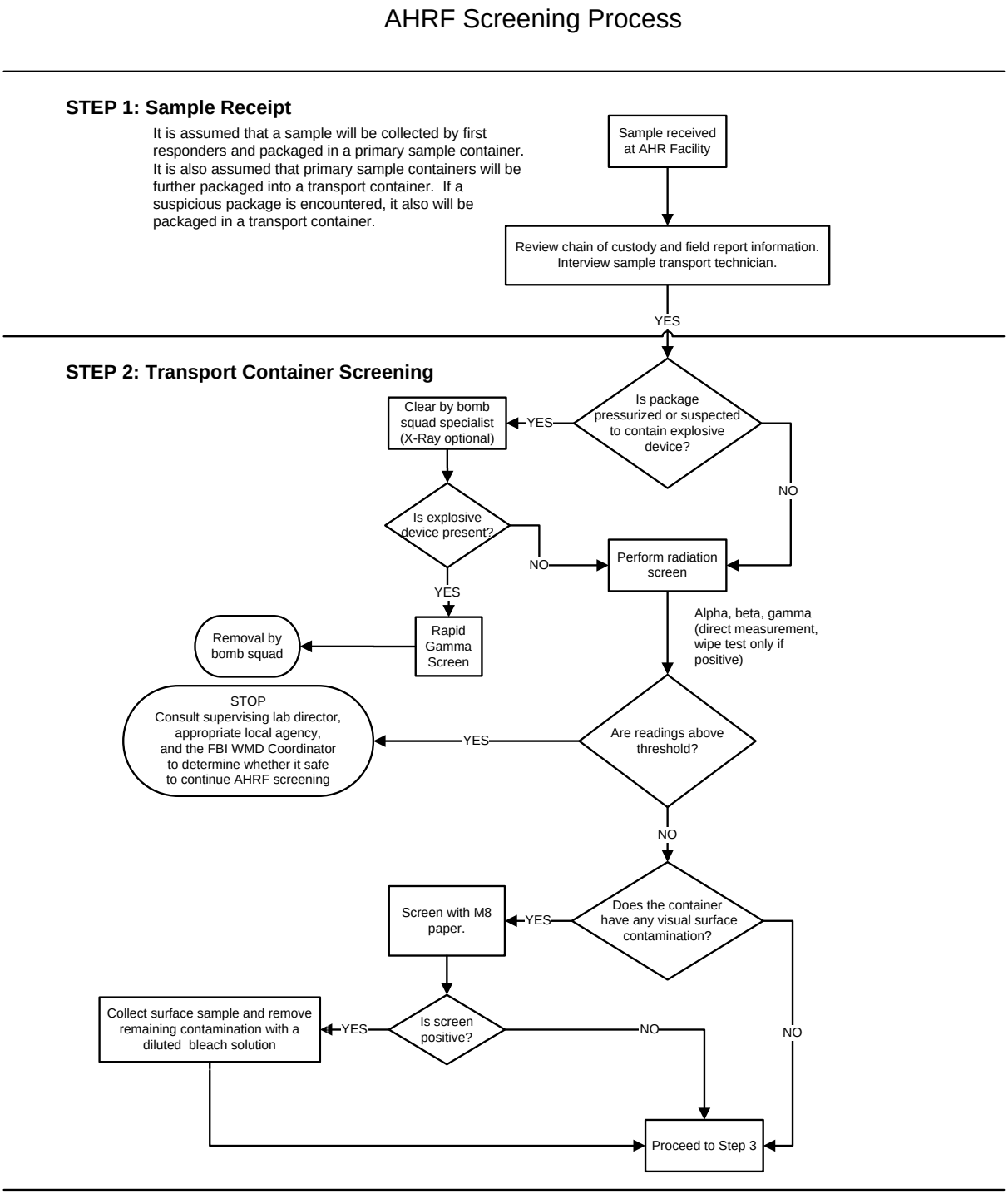

SAMPLE RECEIPT and TRANSPORT CONTAINER SCREEN: Outside AHRF
Establish/Continue COC
Review corresponding documentation and Interview the delivery technician
Visual inspect transport container (check for explosive device, radiation and unusual liquid or powder. If present collect sample, mitigate hazard and contact appropriate authorities)
Document observations, complete Sample Receipt Forms, and assign tracking identification
Carry out a Threat Assessment and develop a Screening Plan
PRIMARY SAMPLE CONTAINER SCREEN : Inside fume hood
Screen headspace of transport container for CWAs with IMS and FSP
Remove contents from transport container and secondary containment (if necessary)
Visually inspect and screen primary sample container for radioactivity (surface screen), explosives (colorimetric), and CWA (colorimetric)
If hazards are indicated, collect exterior wipe sample, mitigate hazards indicated via decontamination of exterior surface or shielding, and contact appropriate authorities
Document observations and results on AHRF Screening Results Form
Assess need to continue screening process and ability to transfer to glove box
PRIMARY SAMPLE SCREEN: Inside glove box and biosafety cabinet
Transfer primary sample container to glove box
Open primary container and screen for VOCs (PID) and combustible gases (CGI)
Screen primary sample for radiation (surface scan)
If sufficient amount of sample is present, split sample and continue screening process
Remove small portion of the sample and transfer into the biosafety cabinet. Conduct the optional screen using IMS and/or FSP. Conduct the thermal susceptibility test to determine if explosive materials are present.
Perform water solubility and reactivity test
Perform DB-3 Dye test for alkylating agents (colorimetric)
Perform pH and starch iodide test (colorimetric)
Perform nerve agent test (colorimetric)
Perform the additional chemical screening as needed (colorimetric)
Document observations and results on AHRF Screening Results Form
DOCUMENT RESULTS
Complete and verify AHRF Screening Results Forms
Compile all forms into a single AHRF Screening Report
Contact sampling agency, appropriate local authorities, the local laboratory director, and the FBI WMD Coordinator
Prepare sub sample and primary sample for delivery to the designated laboratory(ies) and/or sampling authority
Transfer to the bio safety cabinet to await transfer

Acronyms:

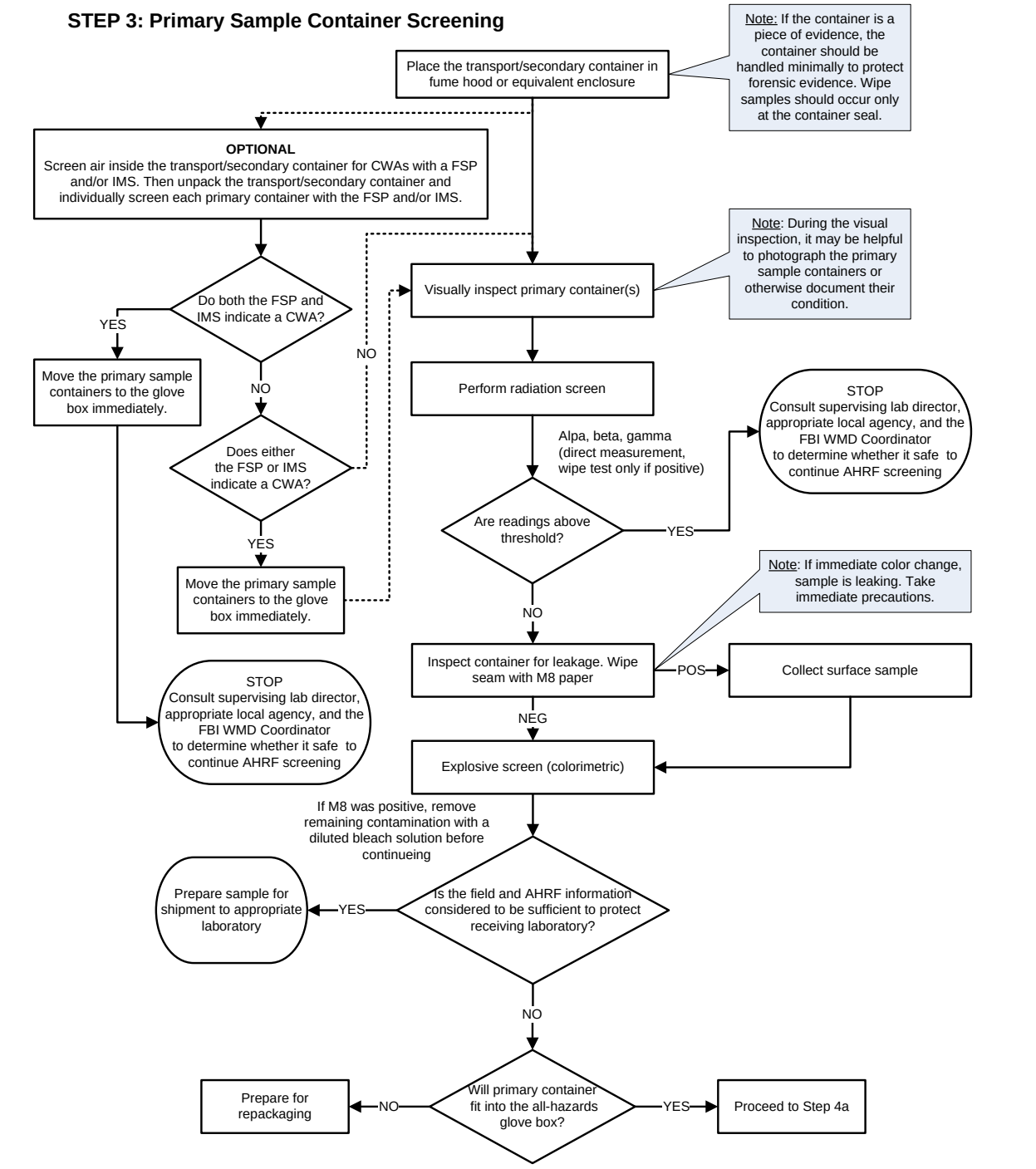
CGI- Combustible Gas Indicator CWA- Chemical Warfare Agent FSP- Flame Spectrophotometer
IMS- Ion Mobility Spectrometer PID- Photoionization Detector WMD- Weapons of Mass Destruction
VOC- Volatile Organic Compounds COC- Chain of Custody

As summarized above, samples will go through a four-step screening process prior to laboratory analysis. Figure 2 provides details of the sample screening steps that will be performed at the AHRF.

Figure 2. AHRF Screening Protocols Flowchart

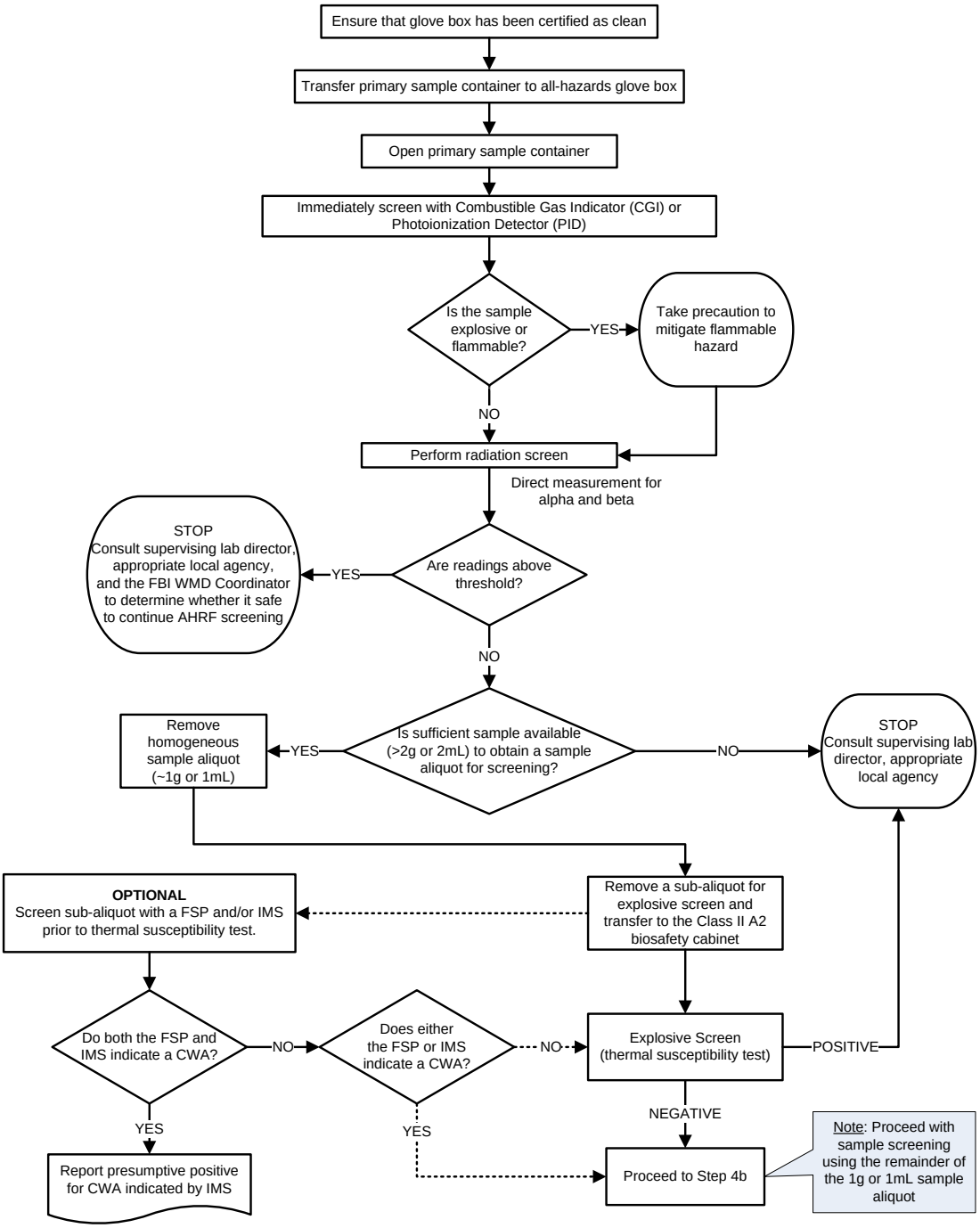

AHRF Screening Process
STEP 1: Sample Receipt
It is assumed that a sample will be collected by first responders and packaged in a primary sample container. It is also assumed that primary sample containers will be further packaged into a transport container. If a suspicious package is encountered, it also will be packaged in a transport container.
Sample received at AHR Facility
Review chain of custody and field report information. Interview sample transport technician.
YES
STEP 2: Transport Container Screening
Is package pressurized or suspected to contain explosive device?
YES
Clear by bomb squad specialist (X-Ray optional)
NO
Is explosive device present?
NO
Perform radiation screen
YES
Rapid Gamma Screen
Removal by bomb squad
Alpha, beta, gamma (direct measurement, wipe test only if positive)
Are readings above threshold?
YES
STOP
Consult supervising lab director, appropriate local agency, and the FBI WMD Coordinator to determine whether it safe to continue AHRF screening
NO
Does the container have any visual surface contamination?
YES
Screen with M8 paper.
NO
Is screen positive?
YES
Collect surface sample and remove remaining contamination with a diluted bleach solution
NO
Proceed to Step 3

AHRF Screening Process (Continued)

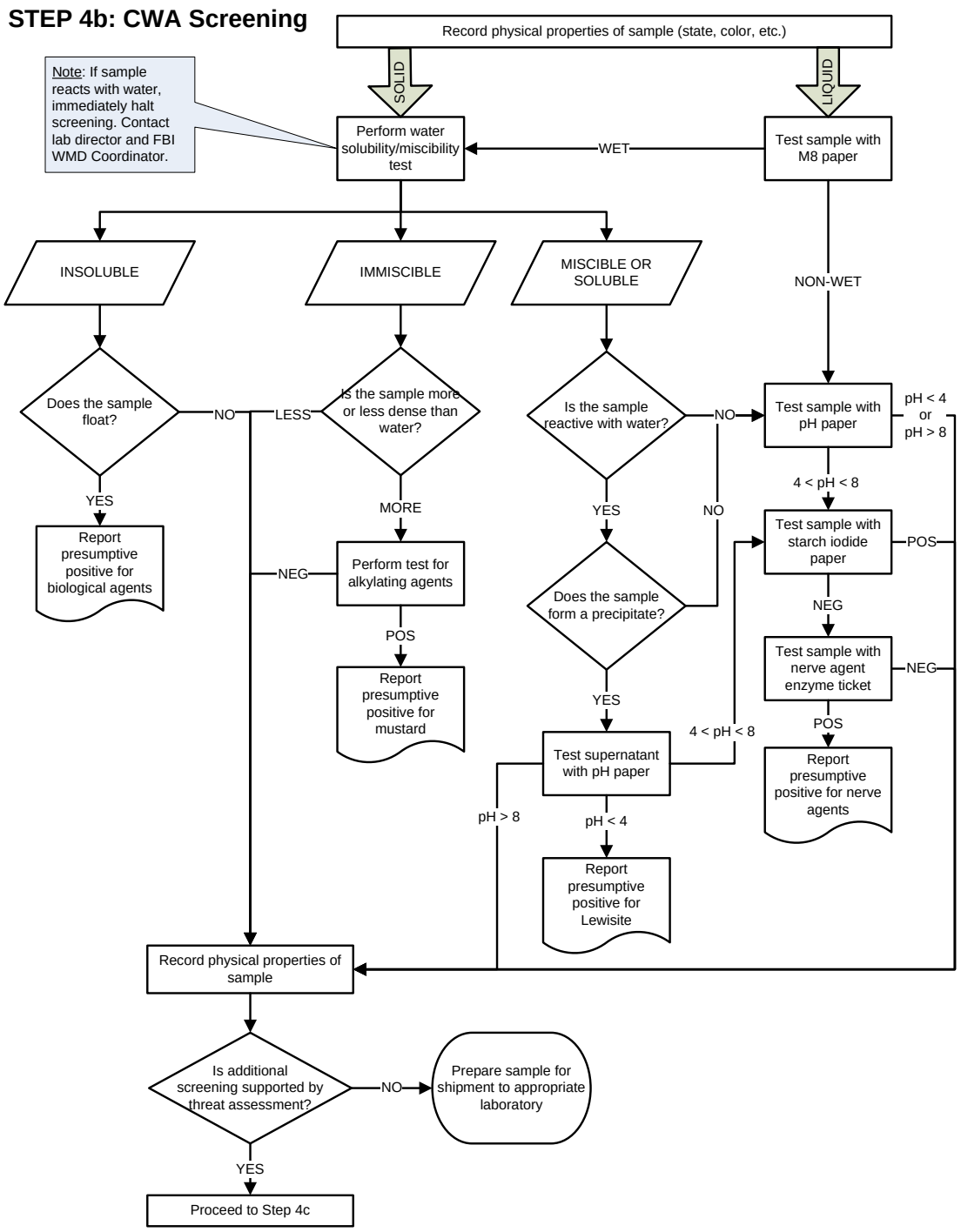

STEP 3: Primary Sample Container Screening
Place the transport/secondary container in fume hood or equivalent enclosure
Note: If the container is a piece of evidence, the container should be handled minimally to protect forensic evidence. Wipe samples should occur only at the container seal.
OPTIONAL
Screen air inside the transport/secondary container for CWAs with a FSP and/or IMS. Then unpack the transport/secondary container and individually screen each primary container with the FSP and/or IMS.
Visually inspect primary container(s)
Note: During the visual inspection, it may be helpful to photograph the primary sample containers or otherwise document their condition.
Do both the FSP and IMS indicate a CWA?
YES
NO
Move the primary sample containers to the glove box immediately.
Perform radiation screen
Does either the FSP or IMS indicate a CWA?
NO
YES
Move the primary sample containers to the glove box immediately.
Alpa, beta, gamma (direct measurement, wipe test only if positive)
Are readings above threshold?
YES
STOP
Consult supervising lab director, appropriate local agency, and the FBI WMD Coordinator to determine whether it safe to continue AHRF screening
NO
Note: If immediate color change, sample is leaking. Take immediate precautions.
Inspect container for leakage. Wipe seam with M8 paper
POS
Collect surface sample
NEG
STOP
Consult supervising lab director, appropriate local agency, and the FBI WMD Coordinator to determine whether it safe to continue AHRF screening
Explosive screen (colorimetric)
If M8 was positive, remove remaining contamination with a diluted bleach solution before continueing
Is the field and AHRF information considered to be sufficient to protect receiving laboratory?
YES
Prepare sample for shipment to appropriate laboratory
NO
Will primary container fit into the all-hazards glove box?
NO
Prepare for repackaging
YES
Proceed to Step 4a

AHRF Screening Process (Continued)

STEP 4a: Initial Sample Screening

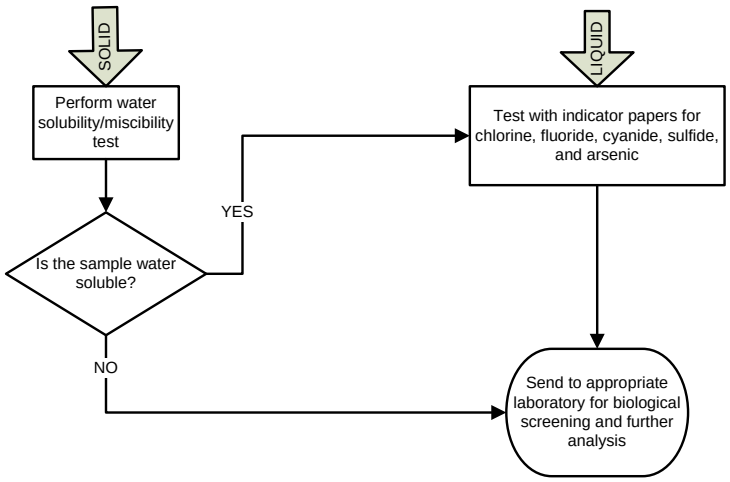

Ensure that glove box has been certified as clean
Transfer primary sample container to all-hazards glove box
Open primary sample container
Immediately screen with Combustible Gas Indicator (CGI) or Photoionization Detector (PID)
Is the sample explosive or flammable?
YES
Take precaution to mitigate flammable hazard
NO
Perform radiation screen
Direct measurement for alpha and beta
Are readings above threshold?
YES
STOP
Consult supervising lab director, appropriate local agency, and the FBI WMD Coordinator to determine whether it safe to continue AHRF screening
NO
Is sufficient sample available (>2g or 2mL) to obtain a sample aliquot for screening?
YES
Remove homogeneous sample aliquot (~1g or 1mL)
NO
STOP
Consult supervising lab director, appropriate local agency
OPTIONAL
Screen sub-aliquot with a FSP and/or IMS prior to thermal susceptibility test.
Remove a sub-aliquot for explosive screen and transfer to the Class II A2 biosafety cabinet
Do both the FSP and IMS indicate a CWA?
NO
Does either the FSP or IMS indicate a CWA?
NO
Explosive Screen (thermal susceptibility test)
POSITIVE
YES
YES
NEGATIVE
Report presumptive positive for CWA indicated by IMS
Proceed to Step 4b
Note: Proceed with sample screening using the remainder of the 1g or 1mL sample aliquot

AHRF Screening Process (Continued)



AHRF Screening Process (Continued)

STEP 4c: Additional Screening of Sample


SOLID
LIQUID
Perform water solubility/miscibility test
Test with indicator papers for chlorine, fluoride, cyanide, sulfide, and arsenic
YES
Is the sample water soluble?
NO
Send to appropriate laboratory for biological screening and further analysis

Note: This Interim All Hazards Receipt Facility Protocol currently does not include a biological screening process. Potential "low tech" and low cost screening methods are being assessed and may be added at a later date.

Some interested parties have suggested that it may be more practical to screen unknown samples for radiological, explosive, and chemical threats and then send the sample directly to an LRN lab. This suggestion is based on concerns related to the amount of available sample material, timing (urgency), and qualified expertise. Others, however, have suggested that using minimal biological screening (e.g., immunoassay or ATP bioluminescence) to detect the presence of biological activity may be warranted under some conditions. These techniques may be reasonable and appropriate depending on a given facility's capabilities. EPA is continuing to assess the feasibility of biological screens for the purposes of this project.

2.0 Sample Receipt

Prior to performing any screening of a sample or sample container at an AHRF, a number of activities should be performed to ensure sample integrity, the validity of field screening results, and the safety of facility and laboratory personnel. AHRF staff performing these activities should use a Sample Receipt Form to document completion of the activities in this section. An example AHRF Sample Receipt Form is provided as Attachment 2.

The following procedures assume that samples will be collected by first responders and packaged in multiple layers of containment. The primary sample container is the vessel that physically contains the unknown material to be screened. Once this layer of containment is breached the primary sample is exposed. The primary sample container can be any type of container that can physically contain the unknown material. It can be provided by the first responders collecting the sample, or it may be part of the evidence itself. In the case of it being part of the evidence itself, great care should be taken to retain the trace evidence (e.g. fingerprints, DNA etc.) that may be present on the container. The primary sample container often will be placed in a secondary containment vessel to provide spill control and protection measures to the primary sample container and sample. The secondary containment may consist of a resealable plastic bag or another larger container. The secondary containment vessel containing the primary sample container and sample should then be packaged further into a transport container for shipment to the AHRF or other laboratory. The transport container may be a cooler or other suitable container with proper packaging to minimize breakage and leakage during transport. If a suspicious package is encountered, it should follow the same general guidelines and should be placed into a transport container for shipment to protect the evidence and sample contained within the package.

2.1 Interview the Sample Delivery Personnel and Verify the COC and Field Documentation

It is important to interview the sample delivery personnel to ensure all the pertinent information regarding the sample's background is documented (i.e. collection, packaging, transport, handling, hazards, etc.). Each sample received at the AHRF should have a corresponding COC form. An example COC is provided as Attachment 3. The COC form should provide information regarding sample transfer, including any occasion during which a sample may have been left unattended. Each sample that is delivered to the AHRF should have an accompanying sample field report or emergency sample form. The information provided in these documents should be reviewed and evaluated to assist in determining the type and extent of Facility screening that will be performed, as well as the type and extent of personal protection and safety precautions that are necessary. This information also may be used by laboratories, along with AHRF screening results, to determine the type and extent of laboratory analysis and safety precautions necessary.

These documents should be reviewed to verify and evaluate sample transport information prior to bringing the sample into the AHRF and prior to initiation of any screening.

2.1.1 Have the delivery personnel place the transport container on a stable surface in a sample receipt staging area. Immediately notify others in the AHRF that a sample has arrived.

> WARNING! Do not shake or move the transport container unnecessarily. Do not sniff, touch, or show the container to others.

2.1.2 Request proof of identification (i.e., government-issued picture ID) and documentation. Review the identification against the signature on the COC.

2.1.3 Interview the delivery personnel and check this information against the sample COC.

2.1.3.1 Information obtained during this interview includes the following:

- Whether there are known potential hazards or dangers posed by the sample

> WARNING! If hazards or dangers posed by the sample are imminent, mitigate them immediately before continuing the sample receipt process. If the sample is suspected to contain a specific hazard proceed to Section 3.1 for Explosives and 3.2 for Radiation. If field screening for Explosives or Radiation has not been performed, treat the sample as containing these materials and proceed to Sections 3.1 and/or 3.2.

- Identity/information for any unusual substance on the outside of the transport container

> WARNING! If an unusual substance is present on the outside of the transport container and no information can be gained regarding its identity, STOP and screen the container using the procedures described in Section 3.3.

- Sample type and source
- Date, time, and location where delivery personnel first got possession of the sample
- Sample condition and/or containment when delivery personnel first got possession of the sample (e.g., is there a custody seal and is it broken?)
- Whether any of the containers are pieces of evidence, and if so, whether they have been placed in an appropriate containment bag.

- How sample is contained (i.e., primary, secondary, transport container, etc.)
- Contacts or responsible parties
- Comments or observations regarding conditions of sample transport

2.1.4 Identify the sample by type. Sample type categories includes the following:

- Water (e.g., groundwater, drinking water, stream, reservoir, other water body)
- Soil (e.g., surface, sub-surface)
- Liquids (e.g., oils, leachate, detergent)
- Petroleum product or solvent based (e.g. car explosion, chemical leak)
- Solids (e.g., powder, chips scraped off of a surface)
- Wipes (e.g., cloth with or without a solvent)
- Air filters (e.g., filters from field sampling equipment, automotive vehicles or equipment operating in direct area)
- Suspicious packages
- Gas bombs or canisters (e.g., vacuum filled, pressurized containers)

WARNING! The AHRF is not equipped to handle gas bombs, canisters, or gas cylinders that are under pressure. Handle with extreme caution and immediately obtain the assistance of a bomb squad to remove it.

2.1.5 Identify samples by known and unknown sources.

- Known source: collected by a field technician or remote sensing/monitoring equipment, and controlled in a sample container.
- Unknown source: discovered by field technician or agent, source unidentified, placed in containment bag or other type of container at scene.

2.1.6 Segregate samples from known and unknown sources for screening. Samples from known sources may require less screening at the AHRF, depending on review of the field reports and first responder's knowledge of the sampling site and event impact.

2.1.7 Review the COC form.

2.1.7.1 At a minimum, the COC Form should include the following information:

- Sample description
- Sample identification code or number
- Date, time, and location of sample collection
- Number of samples collected and transported
- Number of containers collected for each sample
- Identification of sample collector

- Contact information for a principal investigator, project manager, or project coordinator
- The names of any person or persons handling the sample
- The time and location of any transfer of sample possession
- If a sample has been left unattended, information regarding the location and conditions of sample storage (i.e., sample was stored in a locked compartment or container)

2.1.7.2 This COC Form also may include information regarding the following:

- Sample containers used
- Sample container decontamination
- Transport containers used
- Type and conditions of transport

2.1.8 Review the Sample Field Report

2.1.8.1 Check the sample field report for completeness and suspicious indicators, and update it as necessary.

2.1.8.2 At a minimum, this report should include the following information:

- Location, date, and time of sample collection
- Sample identification number
- If field tests have been performed, the field report should contain the types of tests performed (e.g., specific chemical, biological, radioactivity, explosives field measurements), the testing equipment used, date and time testing was performed, the results of the tests, and the person(s) performing each test
- Noted environmental and/or human health impacts
- Name(s) of field personnel collecting the sample and performing field tests

2.1.8.3 These reports also may include information regarding:

- Reason for sample collection
- Event description
- Risk assessment
- Number of people exposed, type of exposure, and symptoms (e.g., blistering, skin/eye/nose/mouth irritation, disorientation, respiratory problems, convulsions, death, none)
- Sample type (e.g., envelope, package, swab, swipe, air, water (and source of water), soil, petroleum product or solvent)
- Physical state of sample (e.g., solid, liquid, gas)
- Sample appearance (e.g., granular, powder, oily, color)
- Sample amount (approximate)

- Preservative or other chemical or material, if any, added to the sample
- Identification of person(s) who have been informed of the event

2.2 Visually Inspect the Sample Container and Confirm Information

This visual inspection will allow the AHRF personnel to confirm the information provided by the delivery personnel and documentation. In cases where a risk is known or expected as a result of field screening or site evaluation, a label or placard may be attached to the sample transport container providing information regarding associated risks (e.g., radioactive, explosive, corrosive, toxic, or flammable). As a precaution, AHRF personnel should assume that any unlabeled sample transport container contains hazards until the contents are further screened or evaluated. The possibility that containers may be mislabeled also should be considered. Record results of the following visual inspection on the Sample Receipt Form (Attachment 2).

WARNING! Sample transport containers should not be opened during any sample receipt activities, including during visual inspection of the container.

2.2.1 Have the delivery personnel place the transport container into the sample entrance air lock.
2.2.2 Don appropriate PPE.
2.2.3 Move sample into the fume hood or equivalent environmental enclosure.
2.2.4 Visually inspect the sample transport container.
2.2.4.1 Examine the sample transport container for suspicious indicators.
2.2.4.1.1 Potential suspicious package indicators include the following characteristics:

- Protruding wires
- Rigidness or bulkiness
- Strange odors (only obvious odors – DO NOT sniff the sample container)
- Oily stains, discoloration, or crystallization
- Excessive tape or string
- Unusual or unexpected contamination on the container (e.g., bright colored substances, crystalline deposits, liquid)
- Damaged, bulging, or discolored container

WARNING! If any of the suspicious indicators are present, mitigate imminent hazards, isolate the sample and consult the appropriate authorities for assistance before further handling. Proceed to Section 3.1 Explosives, 3.2 Radiation, or 3.3 Unusual Substances.

2.2.4.2 Inspect the sample container to ensure sample integrity.

2.2.4.2.1 Check the following items:

- Condition of transport container. Is it intact?
- Transport container seal. Is it properly sealed?
- Custody Seal. Is it unbroken?
- Labels. Are they consistent with the information contained in the COC form and/or field report?
- Placards/labels that provide information regarding associated risks (e.g., radioactive, explosive, corrosive, toxic, or flammable). Does it match the documentation provided?

2.2.4.2.2 NOTE: Some transport containers may have a custody seal and will not have a label or vice versa. If the transport container does not contain a custody seal, the primary container(s) should be examined for these seals once the primary containers are unpacked from the transport container and secondary containment vessels inside the fume hood or equivalent environmental enclosure (See Section 4.2).

2.2.4.3 If possible, photograph the transport container and all labels, placards, seals etc.

2.2.4.4 If the sample transport container is damaged, discolored, or leaking, place the container in a secondary container to control possible spillage prior to transferring the sample to the glove box. Ensure that no personnel have any direct contact with the leaking substance. Increased PPE may be necessary including respiratory protection (See Attachment 1). Proceed to Section 3.3 to mitigate this hazard.

2.3 Receive Sample and Assign Sample Tracking Identification

2.3.1 Transfer custody of the sample to AHRF personnel.

2.3.1.1 Document sample receipt and release using signature, date, time, and location of the transfer. NOTE: Each person accepting custody of the sample accepts the responsibility for ensuring the integrity and security of that sample.

2.3.1.2 Have delivery personnel sign the Sample Receipt Form (Attachment 2) and the sample COC (Attachment 3). Ensure they include their printed name, affiliation, date and time along with their signature.

2.3.2 Enter an AHRF sample tracking identification number on the sample label, container, or containment bag. NOTE: The sample tracking identification number may be identical to the sample ID number used on the COC.

2.3.3 Enter sample tracking identification on the COC and field report forms.

2.3.4 If possible, make a copy of the completed COC form, custody seals, and any other documentation and maintain them in the AHRF records.

2.3.5 Seal the completed original COC form, along with any other accompanying documentation, in a resealable plastic bag and include it with the sample report and tracking forms (See Section 2.5 and Attachment 4) that accompany each sample through the facility screening processes.

2.4 Prepare the AHRF Sample Screening Forms Packet

2.4.1 Compile the forms packet that will accompany the sample through the AHRF screening process.

2.4.1.1 Forms that accompany each sample should include:

- The original sample COC form
- The original field report
- Facility Sample Receipt Form (Attachment 3)
- Facility Screening Results Forms:
  - Transport Container Screening Results (Attachment 4a)
  - Primary Sample Container Screening Results (Attachment 4b)
  - Sample Screening Results (Attachment 4c)

2.4.2 Enter sample tracking identification number on the Screening Results Forms (Attachment 4).

2.4.2.1 The results of all AHRF screening procedures should be recorded on the AHRF Screening Results Forms (See Attachment 4) as well as the signatures of the screening technicians and the date and time of each screening test.

2.5 Threat Assessment: Review the Results and Determine the Facility Screening Plan

Results and observations noted during sample receipt should be reviewed and evaluated to maximize sample screening efficiency and personnel protection. Information regarding personal protective equipment (PPE) that should be available at the AHRF is included in Attachment 1. It is possible, for example, that AHRF staff may desire to use Level B or C protection when moving and/or screening suspicious packages for which there is no available field screening information. Samples that have been identified as coming from a known source (e.g., drinking water) with no indication that the sample may contain an explosive device should not require an explosives device screen. Information obtained during the sample receipt process can be used to make decisions regarding the level of protection needed and to ensure that facility staff has proper PPE. The minimal amount of PPE that is considered to be necessary for performing AHRF screening activities

includes two pairs of nitrile gloves, eye protection, and protective clothes covering. (NOTE: If CWAs are suspected to be present in a sample, one pair of non-standard butyl gloves should be used as outer gloves worn over a single pair of nitrile gloves.) Nitrile gloves should be replaced between every sample or every five minutes whichever comes first. Equipment also should be available such that AHRF personnel can increase the PPE if desired or needed. Once the level of PPE and AHRF screening plan has been developed the appropriate local authorities and FBI WMD Coordinator should be made aware of the sample and the screening plan based on the information received during the sample receipt process.

2.5.1 Determine AHRF screening plan.

2.5.1.1 AHRF staff including the supervising lab director should use best professional judgment to evaluate the information provided during sample receipt to determine the extent of facility screening that should be necessary to expeditiously and accurately provide the information needed to protect the laboratory and the level of PPE to be worn. Example decisions include the following:

- If the sample transport container is suspected to contain an explosive device, or explosive or shock-sensitive material as determined by visual inspection (i.e., protruding wires, rigidness or bulkiness, excessive tape or string), seek bomb squad assistance before further handling.
- Immediately obtain expert assistance in removing gas bombs, canisters, or gas cylinders that are under pressure from the AHRF.
- If information in the field report indicates an immediate threat or health risk (e.g., exposure resulted in blistering, disorientation, respiratory problems, convulsions, and/or death), facility staff should increase the level of PPE.
- If the sample is identified as a suspicious powder, and there is indication of an intentional threat, AHRF screening should focus on protecting biological laboratories and increasing the level of PPE used by facility personnel through a detailed threat assessment and screening plan.
- If the receiving laboratory is equipped to handle samples containing hazardous chemicals (e.g., arsenic, cyanide, organic vapors), AHRF screening should focus on radioactivity, explosives, and chemical warfare agents.

2.5.1.2 If a hazard has been identified or ruled out in the field with certainty, corresponding screening steps may not be necessary at the AHRF.

3.0 Sample Transport/Secondary Container Screening

The sample transport container is screened for explosive devices and radioactivity prior to screening the primary sample container(s) or the sample itself. If possible, sample transport containers are screened in a staging area outside of the AHRF for explosive devices if they are suspected. Ideally, any sample suspected of containing explosive devices would have been screened before arriving. NOTE: If the primary sample container is packaged in both a secondary container and a transport container, an abbreviated screening of the transport container is performed. Abbreviated screening includes explosive, gamma and M8 screening. The full screening is performed on the secondary container instead.

> WARNING! Do not open sample transport containers during the transport container screening process. Transport containers should be moved into the chemical/biological fume hood inside the AHRF for removal and screening of primary sample containers.

3.1 Sample Transport/Secondary Container Screen for Explosive Device

3.1.1 Explosive Device Screening Procedures

3.1.1.1 Inspect the container to determine if any suspicious indicators are present such as the following:

- Protruding wires
- Rigidness or bulkiness
- Excessive tape or string

3.1.1.2 If a sample is suspected to contain an explosive device, isolate the sample and notify a bomb squad immediately.

3.1.1.2.1 Isolating the sample involves placing the sample container in a blast box if one is available and moving it as far away from people and buildings as possible, while still keeping it in a secure area.

> WARNING! Samples that are suspected to contain an explosive device should be cleared by a bomb squad prior to continuing Facility screening.

3.1.1.3 If the AHRF has the available equipment, perform an X-ray screen of the transport container (optional). Any X-ray screening of containers suspected to contain an explosive device should be performed with permission and supervision of a bomb specialist.

3.1.1.4 If an explosive device is determined to be present, follow the procedures below:

3.1.1.4.1 Perform a quick gamma dose rate screen to determine if any significant radioactivity is present (see Section 3.2.2). Perform this screening with the permission and supervision of the bomb squad.

3.1.1.4.2 Record the results of the X-ray and radiation screens on the Facility Transport Container Screening Results Form (Attachment 4).

3.1.1.4.3 Transfer custody of the container to the bomb squad, along with corresponding report forms. NOTE: Ensure copies are maintained in the AHRF files.

3.1.1.5 If an explosive device is determined to not be present, proceed to Section 3.2 to perform a full radiation screening of the transport container.

3.2 Sample Transport/Secondary Container Screen for Radiation

3.2.1 Radiation Screen Background

3.2.1.1 Radiation screening should be performed by personnel trained in or familiar with the radiation screening equipment that is used. It is recommended that a certified radiation technician perform this screening. Use of radiation screening equipment is complicated, and several calculations are required to obtain screening results.

3.2.1.2 Only high energy beta or gamma radiation will penetrate the sample transport container. An alpha/beta scan will provide an indication of the presence of any radioactive contamination on the outside of the transport container, or of any high energy beta radiation that is in the sample. A gamma scan will provide an indication of the presence of any gamma radiation in the sample or on the container.

3.2.2 Gamma Radiation Screen Procedure

3.2.2.1 Perform a gamma dose rate screen of the sample transport container.

3.2.2.2 Point the meter at the sample. The probe is located inside the front bottom edge of the meter for most gamma scintillators. Observe the meter readings. It may be necessary to change scales to maintain on-scale readings.

3.2.2.3 Monitor dose rates at approximately 18 inches and again at 1 inch from the container. Static one-minute measurements should be collected in random locations at each distance. Record the highest level at each distance, noting the probe location relative to the container.

3.2.2.4 Record screening results on the Facility Transport Container Screening Results Form (Attachment 4).

3.2.3 Gamma Radiation Screen Results

3.2.3.1 Typical background for gamma radiation is 5 to 20 micro R (roughly 0.005 to 0.02 mR or mrem).

3.2.3.2 The recommended gamma threshold is:

Gamma threshold: 0.5 mrem/hr (roughly equal to 0.5 mR/hr or 500 microR/hr for gamma radiation)

3.2.3.3 This threshold is taken from the USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water - Criteria and Procedures Quality Assurance* and is recommended by the USEPA Office of Radiation and Indoor Air.

3.2.3.4 Each facility should set the threshold depending upon their capability for handling radioactive substances.

3.2.3.5 If results of the direct read are less than twice the average background and thus less than the thresholds, proceed with Section 3.3 and Section 4 below.

3.2.3.6 Screening results that indicate a gamma dose rate greater than the threshold should halt AHRF screening procedures.

3.2.3.7 Place the container in a steel or lead lined box, if one is available or other appropriate shielding materials and isolate the sample in a secure area.

3.2.3.8 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

3.2.3.9 If not, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

3.2.3.10 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

3.2.4 Direct Read Alpha and Beta Radiation Screen Procedures

3.2.4.1 Set the toggle switch on the meter should to alpha/beta counts.

3.2.4.2 Focusing on the areas of the container that are most likely to be contaminated (e.g., bottom of the container, lid opening, handles, and container seams), preform a direct read alpha/beta scan of the sample transport container.

3.2.4.3 Scan the container as close to its surface as possible (e.g., ¼ inch from the surface of the container), without allowing the instrumentation to come in contact with the surface.

3.2.4.4 Observe the meter reading and listen to the meter. Positive responses are in different click tones for either alpha or beta.

3.2.4.5 If a positive reading occurs, select either alpha or beta on the toggle switch to obtain a true reading. NOTE: It may be necessary to change scales to maintain on-scale readings.

3.2.4.6 These counts are converted to counts per minute, and then to an activity unit [either disintegrations per minute (dpm) or Bequerels (Bq)]. The activity is then calculated for the area of the screen (See Appendix F, References).

3.2.4.7 Record the alpha and beta counts on the Facility Transport Container Screening Results Form (Attachment 4).

3.2.5 Direct Read Alpha and Beta Radiation Screen Results

3.2.5.1 Typical background for alpha radiation is 5 to 20 micro R.

3.2.5.2 Typical background for beta radiation is 5 to 20 micro R.

3.2.5.3 The recommended alpha and beta thresholds are:

Alpha threshold: 22 dpm/100 cm^2
Beta threshold: 2200 dpm/100 cm^2

3.2.5.4 These thresholds are taken from the USEPA's Manual for the Certification of Laboratories Analyzing Drinking Water - Criteria and Procedures Quality Assurance, 5th Edition, EPA 815-R-05-004, Jan 2005, and is recommended by the USEPA Office of Radiation and Indoor Air.

3.2.5.5 Each facility should set the threshold depending upon their capability for handling radioactive substances.

3.2.5.6 If results of the direct read are less than twice the average background and thus less than the thresholds, proceed with Section 3.3 and Section 4 below.

3.2.5.7 If the direct alpha/beta radiation screens indicate radiation above twice the average background level (either the typical background or a background level that has been determined for the AHRF), proceed to Section 3.2.6 and perform a wipe test on the outside of the sample transport container to determine if removable contamination is present.

3.2.5.8 If screening results indicate alpha and/or beta dose rates greater than the threshold halt AHRF screening procedures.

3.2.5.9 Place the container in a steel or lead-lined box, if one is available or other appropriate shielding materials and isolate the sample in a secure area.

3.2.5.10 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

3.2.5.11 If not, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

3.2.5.12 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

3.2.6 Wipe Alpha and Beta Radiation Screen Procedures

WARNING! It is important to note that an AHRF may receive suspicious packages or containers. These packages or containers should be considered to be and handled as evidence. Suspicious packages should be handled as little as possible, taking care to maintain the integrity of any potential evidence the package may provide (e.g., finger prints, container or material manufacturer, physical particles). Package handling should be minimized, and wipe samples should be collected only from target areas, such as the seam of the container and lid.

3.2.6.1 Wipe an adequate number of locations to ensure that there is a degree of confidence that the container has been thoroughly evaluated for loose contamination.

3.2.6.2 The wipe locations should include the top, bottom, lid (especially the opening), handles, and sides of the container.

3.2.6.3 Place wipe samples on planchets and count.

3.2.6.4 Most of these instruments read individual counts for alpha and beta particles simultaneously. The counts are converted to counts per minute or to an activity unit incorporated by an internal conversion constant [either disintegrations per minute (dpm) or Bequerels (Bq)]. If necessary, record the counts and convert to dpm.

3.2.6.5 The results are then divided by the area covered in the smear. A 4 inch square or 1 x 16 inch swipe is equal to 100cm^2. If less area is available to swipe, determine the approximate area and convert the results as necessary.

3.2.6.6 Record the alpha and beta counts on the Facility Transport Container Screening Results Form (Attachment 4).

3.2.7 Wipe Alpha and Beta Radiation Screen Results

3.2.7.1 The recommended alpha and beta wipe thresholds are:

22 dpm / cm^2 - beta and gamma emitters and low toxicity alpha emitters
2.2 dpm / cm^2 - all other alpha emitters

3.2.7.2 These thresholds are taken from 49 CFR 173.443 Contamination Control Table 11 Non-Fixed External Contamination Wipe Limits.

3.2.7.3 Each facility should set the threshold depending upon their capability for handling radioactive substances.

3.2.7.4 If the results of the wipe sample are less than the thresholds (See Section 3.2.7.1), proceed to Section 4.0 (unless there is an unusual substance presence on the transport container as discussed in Section 2.2; if so proceed to Section 3.3, M8 Paper Screen) to perform the screening of the primary sample container(s).

3.2.7.5 If the wipe is above the threshold levels (See Section 3.2.7.1), attempt to decontaminate the container using a wet cloth. Dispose of all cleaning materials as radioactive material.

3.2.7.6 Re-wipe the surface of the container and count the wipes following the procedure above (See Section 3.2.6).

3.2.7.7 Evaluate the results against the established thresholds (See Section 3.2.7.1). If it is below the thresholds, proceed to Section 4.0 (unless there is an unusual substance presence on the transport container as discussed in Section 2.2; if so proceed to Section 3.3, M8 Paper Screen) to perform the screening of the primary sample container(s).

3.2.7.8 If the results are still above the thresholds the container cannot be easily decontaminated, halt AHRF screening procedures.

3.2.7.9 Wrap the container in plastic and other appropriate shielding materials and isolate the sample in a secure area. Place the container in a steel or lead-lined box, if one is available.

3.2.7.10 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

3.2.7.11 If screening cannot continue, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

3.2.7.12 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

3.3 Sample Transport/Secondary Container Screen for Chemical Warfare Agents

3.3.1 M8 Paper Screen Procedures

3.3.1.1 Inspect the container to determine if any unusual material or substances are present, such as the following:

- Strange odors (only obvious odors – DO NOT sniff the transport container)
- Oily stains, discoloration, or crystallization
- Unusual powders (not dirt, dust, dried mud, or any other contamination that might be expected from field sampling)

3.3.1.2 If unusual material is not present, proceed to Section 4.0.

3.3.1.3 If unusual material is present, follow procedures outlined below:

3.3.1.3.1 Wipe the contaminated area(s) of the transport container with M8 paper.

3.3.1.3.2 Observe the reaction with the paper.

3.3.1.3.3 Record the results on the Facility Transport Container Screening Results Form (Attachment 4).

3.3.1.3.4 If positive, collect sample using an appropriate process and wash the outside of the container with a 10% bleach solution, followed by reagent grade water.

3.3.1.3.5 If negative, proceed to Section 4.0.

3.3.2 M8 Paper Screen Results

3.3.2.1 M8 paper is a chemically-treated, dye-impregnated indicator paper. Interaction between the indicator dyes and an organic liquid produces a pH-dependent color change.

3.3.2.2 M8 paper was designed to change color to indicate the presence of non-persistent G-type nerve agent (yellow), V-type nerve agent (dark green), or blister agents (red). However, all organic liquids will be absorbed by M8 paper and produce some color change.

3.3.2.3 For purposes of this screening test, any wetting of the M8 paper and subsequent color change is a positive indicator of sample leakage and appropriate precautions must be taken, including increasing the level of PPE.

3.3.2.4 Proceed to Section 4.0 for both positive and negative results.

4.0 Primary Sample Container Screening

WARNING! It is important to note that an AHRF may receive suspicious packages or containers. These packages or containers should be considered evidence and handled as such. Suspicious packages should be handled as little as possible, taking care to maintain the integrity of any potential evidence the package may provide (e.g., fingerprints, container or material manufacturer, physical particles). Package handling should be minimized, and wipe samples should be collected only from target areas, such as the seam of the container and lid.

4.1 Optional Ion Mobility Spectrophotometer (IMS) and Flame Spectrophotometer (FSP) Screening and Unpacking the Transport Container

4.1.1 IMS and FSP Background

4.1.1.1 The FSP and IMS screens are optional. If only one of these instruments is available, the FSP is recommended due to its sensitivity. Refer to the manufacturer's user manual and be aware of the results produced by and limitations of the equipment used.

4.1.1.2 Most brands of IMS detectors will identify only the class of CWA (i.e., nerve, blister, irritant) that is present in a sample, if more than one CWA has been pre-programmed into the instrument. If the IMS identifies more than one CWA in a sample, only the CWA class will be displayed on the readout.

4.1.1.3 The numerical value assigned to an IMS reading does not correspond to a specific concentration. The IMS will identify the compound and give a relative reading.

4.1.1.4 If an IMS becomes saturated with a high concentration of a chemical, it will go into back flush mode to prevent damage to the detector. When in back flush mode, the instrument cannot be used. If the back flush mode is indicated during a sample screen, the sample is suspected to contain significant quantities of CWAs.

4.1.1.5 FSP detectors provide only an indication of whether a phosphorous or sulfur compound is present it does not identify specific CWAs. Any substance containing phosphorous or sulfur will cause the FSP to respond, regardless of whether the substance is a CWA or a relatively harmless compound.

4.1.2 IMS and FSP Screening Procedures

4.1.2.1 This part of the screening is performed in the fume hood or equivalent environmental enclosure.

4.1.2.2 Screen the transport container with a Flame Spectrophotometer (FSP) and/or Ion Mobility Spectrometer (IMS) by holding the end of the FSP or IMS at the seam of the transport container.

4.1.2.3 Open the transport container approximately 2 to 3 inches and hold the front end of the FSP or IMS in the container opening.

Wait at least 5 seconds for the FSP and 60 seconds for the IMS to see if there is a response.

4.1.2.4 Remove transport container lid and slowly scan the tops of each secondary/primary container with the FSP.

> WARNING! If the FSP or IMS screen indicates that CWAs may be present at any point during this screening, make sure all primary containers remain inside the transport container, re-secure the transport container and immediately notify the local lab director and other appropriate authorities.

4.1.2.5 Remove each secondary/primary sample container from the sample transport container one at a time.

4.1.2.6 Hold the FSP or IMS next to the seal of each secondary/primary container (5 seconds for the FSP and 60 seconds for the IMS).

> WARNING! THE PRIMARY CONTAINER(S) should not be opened, or the sample otherwise exposed until after it has been transferred into the AHRF glovebox (See Section 5.0). If there is any suspicion that the primary container has been breached or an unusual liquid is on the outside of the container, reconsider the level of PPE used and follow the procedures outlined in Section 3.3.

4.2 Visual Inspection of the Primary Sample Container

4.2.1 Visually inspect the sample container to ensure sample integrity.

4.2.2 Check the container type, and make sure the container label matches the COC (see Section 1.4.2).

4.2.3 Check for damage, bulging, discoloration, or leakage. If the container is damaged, bulging, discolored, or leaking, place it into a secondary container or spill tray/tub to control possible spillage.

4.2.4 If possible, record a description of the sample as determined by inspection.

4.2.5 Note color, presence of sediments or foreign material, volume or size/weight.

4.2.6 Check if there is any unusual or unexpected field contamination on the container (e.g., bright colored substances, crystalline deposits, liquid).

4.2.7 Using an infrared thermometer, take sample temperature.

4.2.8 Photograph sample container(s). Place the container next to a ruler or other size indicator. Take as many pictures as deemed appropriate to clearly and accurately document the sample.

4.3 Primary Sample Container Screen for Radiation

4.3.1 Radiation Screen Background

4.3.1.1 Unless the transport container or secondary container is lead-lined there is no reason to perform a gamma scan on the primary sample container since high energy beta or gamma radiation will penetrate the sample containers. If a gamma scan is required, refer to Section 3.2.

4.3.1.2 An alpha/beta scan will provide an indication of the presence of any radioactive contamination on the outside of the primary container(s), or of any high energy beta radiation that is in the sample.

4.3.1.3 Radiation screening should be performed by personnel trained in or familiar with the radiation screening equipment that is used. It is recommended that a certified radiation technician perform this screening. Use of radiation screening equipment is complicated, and some calculations are required to obtain screening results.

4.3.2 Direct Read Alpha and Beta Radiation Screen Procedures

4.3.2.1 Set the toggle switch on the meter to alpha/beta counts.

4.3.2.2 Focusing on the areas of the container that are most likely to be contaminated (e.g., bottom of the container, lid opening, handles, and container seams), perform a direct read alpha/beta scan of the sample transport container.

4.3.2.3 Scan the container as close to its surface as possible (e.g., ¼ inch from the surface of the container), without allowing the instrumentation to come in contact with the surface.

4.3.2.4 Observe the meter reading and listen to the meter. Positive responses are in different click tones for either alpha or beta.

4.3.2.5 If a positive reading occurs, select either alpha or beta on the toggle switch to obtain a true reading. NOTE: It may be necessary to change scales to maintain on-scale readings.

4.3.2.6 These counts are converted to counts per minute, and then to an activity unit [either disintegrations per minute (dpm) or Bequerels (Bq)]. The activity is then calculated for the area of the screen (See Appendix F, References).

4.3.2.7 Record the alpha and beta counts on the Facility Transport Container Screening Results Form (Attachment 4).

4.3.3 Direct Read Alpha and Beta Radiation Screen Results

4.3.3.1 Typical background for alpha radiation is 5 to 20 micro R.

4.3.3.2 Typical background for beta radiation is 5 to 20 micro R.

4.3.3.3 The recommended alpha and beta thresholds are:

Alpha threshold: 22 dpm/100 cm^2 Beta threshold: 2200 dpm/100 cm^2

4.3.3.4 These thresholds are taken from the USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water - Criteria and Procedures Quality Assurance,* and are recommended by the USEPA Office of Radiation and Indoor Air.

4.3.3.5 Each facility should set the threshold depending upon their capability for handling radioactive substances.

4.3.3.6 If results of the direct read are less than twice the average background and thus less than the thresholds, proceed with Section 4.4, Primary Sample Container Explosives Screen.

4.3.3.7 If the direct alpha/beta radiation screens indicate radiation above twice the average background level (either the typical background or a background level that has been determined for the AHRF), proceed to Section 4.3.4 and perform a wipe test on the outside of the sample transport container to determine if removable contamination is present.

4.3.3.8 If screening results indicate alpha and/or beta dose rates greater than the threshold (See Section 4.3.3.3), halt AHRF screening procedures. Place the container in a steel or lead-lined box, if one is available, or other appropriate shielding materials and isolate the sample in a secure area.

4.3.3.9 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

4.3.3.10 If screening cannot continue, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

4.3.3.11 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

4.3.4 Wipe Alpha and Beta Radiation Screen Procedures

WARNING! It is important to note that an AHRF may receive suspicious packages or containers. These packages or containers should be considered evidence and handled as such. Suspicious packages should be handled as little as possible, taking care to maintain the integrity of any potential evidence the package may provide (e.g., fingerprints, container or material manufacturer, physical particles). Package handling should be minimized, and wipe samples should be collected only from target areas, such as the seam of the container and lid.

4.3.4.1 Wipe an adequate number of locations to ensure that there is a degree of confidence that the container has been thoroughly evaluated for loose contamination.

4.3.4.2 The wipe locations should include the top, bottom, lid (especially the opening), handles, and sides of the container.

4.3.4.3 Place wipe samples on planchets and count.

4.3.4.4 Most of these instruments read individual counts for alpha and beta particles simultaneously. The counts are converted to counts per minute or to an activity unit incorporated by an internal conversion constant [either disintegrations per minute (dpm) or Bequerels (Bq)]. If necessary, record the counts and convert to dpm.

4.3.4.5 The results are then divided by the area covered in the smear. A 4 inch square or 1 x 16 inch swipe is equal to 100cm^2. If less area is available to swipe, determine the approximate area and convert the results as necessary.

4.3.4.6 Record the alpha and beta counts on the Facility Transport Container Screening Results Form (Attachment 4).

4.3.5 Wipe Alpha and Beta Radiation Screen Results

4.3.5.1 The recommended alpha and beta wipe thresholds are as follows:

22 dpm / cm^2 - beta and gamma emitters and low toxicity alpha emitters
2.2 dpm / cm^2 - all other alpha emitters

4.3.5.2 These thresholds are taken from 49 CFR 173.443 Contamination Control Table 11 Non-Fixed External Contamination Wipe Limits.

4.3.5.3 Each facility should set the threshold depending upon their capability for handling radioactive substances.

4.3.5.4 If the results of the wipe sample are less than the thresholds (See Section 4.3.5.1), proceed to Section 4.4 (unless there is an

unusual substance presence on the transport container as discussed in Section 2.2; if so then proceed to Section 3.3, M8 Paper Screen) to perform the screening of the primary sample container(s).

4.3.5.5 If the wipe is above the threshold levels (See Section 4.3.5.1), attempt to decontaminate the container using a wet cloth. Dispose of all cleaning materials as radioactive material.

4.3.5.6 Re -wipe the surface of the container and count the wipes following the procedure above (See Section 4.3.4).

4.3.5.7 Evaluate the results against the established thresholds (See Section 4.3.5.1). If they are less then the thresholds proceed to Section 4.4 (unless there is an unusual substance presence on the transport container as discussed in Section 2.2; if so then proceed to Section 3.3, M8 Paper Screen) to perform the screening of the primary sample container(s).

4.3.5.8 If the results are still above the thresholds the container cannot be easily decontaminated, halt AHRF screening procedures.

4.3.5.9 Wrap the container in plastic and other appropriate shielding materials and isolate the sample in a secure area. Place the container in a steel or lead-lined box, if one is available.

4.3.5.10 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

4.3.5.11 If screening cannot continue, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

4.3.5.12 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

4.4 Primary Sample Container Screen for Explosives

4.4.1 Perform an explosive screen using a colorimetric test kit with wipe samples. There are commercially available colorimetric test kits that use multiple reagents to indicate the presence and identification of different types of explosive compounds. These kits usually require collection of one or two wipe samples, which are then exposed to a series of reagents. If a color change occurs after exposure to a reagent, it indicates that a certain type of explosive compound is present.

WARNING! If the sample container is considered to be a piece of evidence, wipe only the seam between the container and its lid. Wipe only part of the seam for each wipe sample taken, because two to three wipes are needed for the explosives screen and one wipe (with M8) paper is needed for the CWA screen (see Section 3.3).

4.4.2 Collect a wipe sample by wiping a representative area (e.g., 2 x 2 inch, depending on container size) of the container or containment bag on all six sides (top, bottom, right, left, front, and back). Make sure that an area of each side remains unwiped to provide enough surface area for any additional wipe tests. When wiping the right, left, front and back, include the area near the container lid and the seam of the container and lid in the representative areas.

4.4.3 Place a few (one to two) drops of liquid from the first reagent bottle on the collection paper.

4.4.4 Observe and record the color change.

4.4.5 Continue to add other reagents or take additional wipe samples as directed by the user manual.

4.4.6 Mark all results on the Facility Primary Sample Container Screening Results Form (see an example form in Attachment 4b).

4.4.7 If any of the colorimetric explosives screens are positive, check the area where the sample containers were wiped for crystallization. If crystallization is present, professional help from a bomb squad should be sought before opening the container.

4.5 Primary Sample Container Screen for Chemical Warfare Agents

4.5.1 M8 Paper Screen Procedures

4.5.1.1 Inspect the container to determine if there are any visual signs of leakage.

4.5.1.2 If no signs of leakage are indicated, follow the procedures outlined below:

4.5.1.2.1 Wipe around the seal and on the outside of the container using M8 paper.

WARNING! If the sample container is considered to be a piece of evidence, wipe only the seam between the container and its lid. Wipe the portion of the seam that was not wiped during the explosive screen (See Section 4.4).

4.5.1.2.2 Observe the reaction with the paper.

4.5.1.2.3 Record the results on the Facility Primary Sample Container Screening Results Form (Attachment 5).

4.5.1.2.4 If positive (See Section 4.5.2), collect sample using an appropriate process and wash the outside of the container with a 10% bleach solution, followed by reagent grade water.

> WARNING! If the sample container is considered to be a piece of evidence, this process will destroy any classical forensic evidence that may be on the outside of the primary sample container. Evaluate the risks before washing the container with bleach and water.

4.5.1.2.5 If negative (See Section 4.5.2), proceed to Section 4.6.

4.5.1.3 If signs of leakage are indicated, follow procedures outlined below:

4.5.1.3.1 Wipe the contaminated area(s) of the container with M8 paper.

4.5.1.3.2 Observe the reaction with the paper.

4.5.1.3.3 Record the results on the Facility Primary Sample Container Screening Results Form (Attachment 5).

4.5.1.3.4 If positive (See Section 4.5.2), collect sample using an appropriate process and wash the outside of the container with a 10% bleach solution, followed by reagent grade water.

> WARNING! If the sample container is considered to be a piece of evidence, this process will destroy any classical forensic evidence that may be on the outside of the primary sample container. Evaluate the risks before washing the container with bleach and water.

4.5.1.3.5 If negative (See Section 4.5.2), proceed to Section 4.6.

4.5.2 M8 Paper Screen Results

4.5.2.1 M8 paper is a chemically-treated, dye-impregnated indicator paper. Interaction between the indicator dyes and an organic liquid produces a pH-dependent color change.

4.5.2.2 M8 paper was designed to change color to indicate the presence of non-persistent G-type nerve agent (yellow), V-type nerve agent (dark green), or blister agents (red). However, all organic liquids will be absorbed by M8 paper and produce some color change.

4.5.2.3 For purposes of this screening test, any wetting of the M8 paper and subsequent color change is a positive indicator of sample leakage and appropriate precautions must be taken, including increasing the level of PPE.

4.5.2.4 Proceed to Section 4.6 for both positive and negative results.

4.6 Continuation of Screening Procedures Assessment

4.6.1 If explosive screens are negative and the sample is not leaking consult with the local laboratory director to determine whether the information provided in the sample COC, field report, and screening results forms is considered sufficient to provide an assessment of risk to the laboratory the AHRF supports.

4.6.2 If information is considered to be sufficient, prepare the sample, field report, COC, Facility Sample Receipt Form and screening results forms for transport to the laboratory.

4.6.3 If additional screening is needed or requested, proceed with Section 4.7 to screen the sample directly.

4.7 Sample Container Evaluation for Transfer to Glove Box

4.7.1 Determine whether the size of the container is suitable for direct screening of the sample inside the all hazards glove box. Sample containers that are too large to pass through the fume hood into the glove box may not be suitable for direct sample screening.

4.7.2 If there is only a very small amount of sample present (< 2 grams or 2 mLs), skip the sample screening procedures described in Sections 5.0 and 6.0. These procedures will consume too much of the sample. For this reason, the sample should proceed directly to the receiving laboratory for analysis.

4.7.3 Air samples, or samples that are contained in a sealed canister, should not be opened in the AHRF. These sample containers should be decontaminated and/or repackaged in the fume hood for removal and transport to an appropriate laboratory or facility.

4.7.3.1 Clean the surface of the containers with 10% bleach solution, and then rinse with deionized or distilled water.

4.7.3.2 Prepare the sample for transfer to an appropriate laboratory or facility.

5.0 Initial Direct Screening of the Sample

Prior to transferring any primary sample containers into the all hazards glove box, the glove box should be decontaminated to ensure samples are not compromised (See Appendix A).

- Collect an aggregate wipe sample on the inside of the glove box (See Appendix A). This sample should be analyzed on site or labeled so that it is easily traceable to the sample that enters the glove box next. This wipe sample will function as a decontamination blank for that sample.

- Run a photoionization detector (PID) and combustible gas indicator (CGI) to test the ambient air in the glove box. Use these results to check that there is no background contamination from earlier samples or other sources.

NOTE: AHRF staff may want to prepare sample screening kits that contain all of the disposable pieces of screening equipment used for direct sample screening (e.g., one or two of each pH, starch iodide, and colorimetric indicator paper, an extra containment bag, a disposable spatula, or any other screening equipment used to test most samples). These kits can enter and exit the glove box with each sample, and help prevent overcrowding and cross contamination.

5.1 Movement of Primary Sample Container(s) into Glove Box

5.1.1 Prior to opening the primary sample container for direct screening of the sample, transfer the container from the fume hood through the double lock doors into a glove box that contains HEPA and carbon filtration.

5.2 Initial Sample Processing

5.2.1 Review the Facility Screening Results Forms to ensure that all required screening of the primary sample container(s) has been performed and recorded (see Section 4.0). If any screening procedures have not been performed, perform these screens either in the glove box or move the container back into the fume hood to complete screening.

5.2.2 Screen the primary sample container prior to opening the container to expose the sample.

5.3 Opening the Primary Sample Container

The sample container should be opened carefully to expose sample contents for radiation, explosive materials, CWAs, and hazardous chemicals screening. Carefully open the primary sample container to expose the sample.

5.4 Primary Sample Screen for Volatile Organic Compounds (VOCs) and Combustible Gases

5.4.1 CGI and PID Screening Background

5.4.1.1 CGI and PID instruments allow the sample to be screened for volatile organic compounds (VOCs) and combustible gases using a multi-gas detector.

5.4.1.2 These instruments typically contain a PID to detect VOCs, a CGI, and an oxygen detector.

5.4.1.3 Many of these instruments can be upgraded to include toxic gas sensors specific to common industrial hazards (carbon dioxide, hydrogen cyanide, etc.).

5.4.1.4 All of the detectors in these instruments can be used simultaneously.

5.4.2 CGI and PID Screening Procedures

5.4.2.1 In order to obtain the most sensitive PID and CGI reading, the reading should be taken on the headspace inside the primary container immediately after the primary container is opened.

5.4.2.2 Shut off all vents in the glove box to minimize air movement and exchange.

5.4.2.3 Hold the end of the detector approximately ½ inch from the sample and observe the instrument readout for at least five seconds. Do not touch the sample or sample container with the detector or the instrument may become contaminated.

5.4.2.4 If the primary sample containment consists of a container inside a containment bag, open the containment bag and then open the sample container, leaving the sample container inside the containment bag. Place the end of the detector in the opening of the bag. Close the bag as much as possible with the end of the detector inside the containment bag, as close to the open end of the sample container as possible. Observe the readings for a few minutes, and record the highest reading. The bag will trap any airborne VOCs or combustible gases from the sample.

5.4.2.5 If the primary sample containment consists of an outer container and another inner container, bring a containment bag into the glove box before the primary sample containers are opened. Remove the inner container from the outer container. Place the inner container inside a containment bag, and open the inner container. Place the end of the detector in the opening of the bag, as close to the open end of the sample container as possible. Close the bag as much as possible with the end of the detector inside the containment bag. Observe the readings for a few minutes and record the highest reading. The bag will trap any airborne VOCs and combustible gases from the sample.

5.4.2.6 Hold the detector in the same location until the results remain constant, record the reading on the Facility Sample Screening Results Form.

5.4.3 CGI and PID Screening Results

5.4.3.1 CGI and PID results only indicate elevated levels of combustible gases or VOCs in the sample, not specific threats.

In addition, the CGI and PID screening tools are influenced by changes in environmental sampling conditions (temperature, humidity, etc.), which could produce anomalous results. Positive results may indicate the presence of flammable, explosive, or toxic hazards, and the sample must be treated with caution. Additional screening will be required.

5.5 Primary Sample Screen for Radiation

5.5.1 Radiation Screen Background

5.5.1.1 A direct read alpha/beta screen using an alpha, beta scintillator with data logger will be done on the primary sample.

5.5.1.2 The test measures alpha/beta radiation from the sample without the shielding that may have been provided by the primary or transport sample containers.

5.5.1.3 This test is a direct measurement and does not consume any sample material.

5.5.2 Direct Read Alpha and Beta Radiation Screen Procedures

5.5.2.1 Set the toggle switch on the meter to alpha/beta counts.

5.5.2.2 Open the primary container and perform a direct read alpha/beta scan of the primary sample.

5.5.2.3 Scan the sample as close to its surface as possible (e.g., ¼ inch from the surface), without allowing the instrumentation to come in contact with the sample.

5.5.2.4 Observe the meter reading and listen to the meter. Positive responses are in different click tones for either alpha or beta.

5.5.2.5 If a positive reading occurs, select either alpha or beta on the toggle switch to obtain a true reading. NOTE: It may be necessary to change scales to maintain on-scale readings.

5.5.2.6 These counts are converted to counts per minute, and then to an activity unit [either disintegrations per minute (dpm) or Bequerels (Bq)]. The activity is then calculated for the area of the screen (See Appendix F, References).

5.5.2.7 Record the alpha and beta counts on the Facility Transport Container Screening Results Form (Attachment 4).

5.5.3 Direct Read Alpha and Beta Radiation Screen Results

5.5.3.1 Typical background for alpha radiation is 5 to 20 micro R.

5.5.3.2 Typical background for beta radiation is 5 to 20 micro R.

5.5.3.3 The recommended alpha and beta thresholds are:

Alpha threshold: 22 dpm/100 cm^2
Beta threshold: 2200 dpm/100 cm^2

5.5.3.4 These thresholds are taken from the USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water - Criteria and Procedures Quality Assurance*, and are recommended by the USEPA Office of Radiation and Indoor Air.

5.5.3.5 Each facility should set the threshold depending upon their capability for handling radioactive substances.

5.5.3.6 If results of the direct read are less than twice the average background and thus less than the thresholds (See Section 5.5.3.3), proceed with Section 5.6, Sample Splitting.

5.5.3.7 If the direct alpha/beta radiation screens indicate radiation above twice the average background level (either the typical background or a background level that has been determined for the AHRF), proceed to Section 4.3.4 and perform a wipe test on the outside of the sample transport container to determine if removable contamination is present.

5.5.3.8 If screening results indicate alpha and/or beta dose rates greater than the threshold (See Section 5.5.3.3) halt AHRF screening procedures.

5.5.3.9 Place the container in a steel or lead-lined box, if one is available or other appropriate shielding materials and isolate the sample in a secure area.

5.5.3.10 Consult a radiological technician, local lab director, appropriate local authorities and the local FBI WMD Coordinator immediately to determine whether screening procedures should continue.

5.5.3.11 If screening cannot continue, the samples should be prepared for transport to a radiological laboratory that can also receive samples with potential biological, explosive, or chemical hazards. NOTE: Alpha, beta, and gamma scans and wipe samples will be necessary on the outermost shipping container. If wipe sample contamination is present, then repackaging the sample in another outer container (e.g., a cardboard box or cooler) is an option.

5.5.3.12 Contact a radiological hazardous waste transport professional to remove the sample from the AHRF.

5.6 Sample Splitting

5.6.1 In order to ensure that sufficient sample is available for laboratory testing and to protect forensics information, an aliquot of sample should be removed for any further sample screening at the AHRF.

5.6.2 Determine if there is sufficient sample available to obtain an aliquot for further testing.

5.6.2.1 There must be a minimum of 2 mL (or 2 grams) of sample to allow approximately 1 mL (or 1 gram) to be removed for

AHRF screening. If there is less than 2 mL (or 2 grams) of sample, halt sample screening and consult the local FBI WMD Coordinator and laboratory director for further direction.

5.6.2.2 If at least 2 mL (or 2 grams) of sample is available, proceed with Step 5.6.3 to obtain a sample aliquot.

5.6.3 A representative and homogeneous sample aliquot of approximately 1 mL (or 1 gram) must be obtained for all additional AHRF sample screening.

5.6.3.1 If the sample is composed of a single matrix, an aliquot should be obtained that is as homogeneous as possible with minimal sample disturbance.

5.6.3.2 If multiple matrices are present, an aliquot should be collected from each matrix.

5.6.3.3 If the sample is composed of multiple liquids, use a clean syringe or pipette to remove a separate aliquot from each liquid phase. Place each liquid aliquot into a separate vial or plate. Each liquid matrix will be screened separately.

5.6.3.4 If the sample is composed of a heterogeneous solid (e.g., multiple colored particles, both oily and dry solids), mix the sample as little as possible while trying to obtain a homogeneous and representative aliquot.

5.6.3.5 If the sample is composed of both a liquid and solid phase, immediately halt sample screening and contact the FBI WMD Coordinator for further instruction.

5.6.4 Once an aliquot has been removed, the remaining sample is retained in the original sample container and packaged for transfer to a receiving laboratory.

5.7 Thermal Susceptibility Test

5.7.1 Thermal Susceptibility Test Background

5.7.1.1 The thermal susceptibility test determines whether the sample contains explosive or energetic materials. The test involves holding a small amount of sample to a flame, and observing the type of reaction.

5.7.2 Thermal Susceptibility Test Procedures

5.7.2.1 Place the smallest visible amount of sample possible on the end of a stainless steel micro spatula.

5.7.2.2 To avoid sample ignition from possible back flash, transfer the sample portion to a Class II biosafety cabinet to perform this test.

5.7.2.3 Insert the sample into the flame of a small hand-held gas lighter (e.g., butane grill lighter with an extended reach).

5.7.2.4 Observe reaction (See Section 5.7.2) and record the results on the AHRF Primary Sample Screening Results Form.

5.7.3 Thermal Susceptibility Test Results

5.7.3.1 If a small explosion, rapid burning (deflagration), or energy release is observed, it is strong evidence that explosive materials may be present. Halt sample screening and contact the appropriate local agency and the local FBI WMD Coordinator.

> WARNING! Some secondary explosives are very stable (e.g., ammonium nitrate), and will not show any reaction to the thermal susceptibility test. However, ammonium nitrate is sometimes mixed with an accelerant such as diesel fuel, which will screen positive for organic vapor during the PID screening.

5.7.3.2 If no response is noted to this test continue the screening process with Section 5.8.

5.8 Water Solubility and Reactivity Test

5.8.1 M8 Paper Test Procedures

5.8.1.1 If the sample is a liquid, place one drop of liquid onto a piece of M8 paper. Observe and record the results. NOTE: M8 paper is hydrophobic; it will not be wetted by aqueous materials, such as CWAs.

5.8.1.2 If the sample is a solid substance, place the smallest amount possible onto a piece of M8 paper. Gently rub it into the M8 paper to determine if there are CWAs in the substance (e.g. VX spilled into soil). Observe and record the results on an AHRF Primary Sample Screening Results Form.

5.8.2 M8 Paper Results

5.8.2.1 M8 Chemical Agent Detection Paper is a chemically-treated, dye-impregnated indicator paper. The paper is hydrophobic, allowing only organic liquids to be absorbed by the paper and interact with the indicator dyes. Interaction between the indicator dyes and a CWA produces a pH-dependent color change.

5.8.2.2 M8 Paper was designed to change color to indicate the presence of non-persistent G-type nerve agent (yellow), V-type nerve agent (dark green), or blister agents (red). However, all organic liquids will be absorbed by M8 paper and produce some color change, so false positives are possible. Therefore, the results of M8 paper screening should be interpreted primarily as a test of whether or not a liquid sample is organic.

5.8.2.3 Organic liquids will be absorbed into the paper, while aqueous solutions will bead on its surface. Although all the nerve and blister agents are organic liquids and will be adsorbed by M8 paper if neat, it should be noted that nerve agents are soluble in

water. Therefore, indication of an aqueous solution on M8 paper does not rule out the presence of a CWA. If the results indicate an organic liquid, proceed with the water solubility/miscibility test (See Section 5.8.3). If the results indicate an aqueous solution, proceed with pH paper screening (See Section 5.10).

5.8.3 Water Solubility and Reactivity Procedures

5.8.3.1 Place ~5 drops of the sample into a 2 mL conical centrifuge tube containing ~0.5 mL of water.

5.8.3.2 Observe and record the results on an AHRF Primary Sample Screening Results Form.

5.8.3.3 If the sample reacts with water (e.g., increase the temperature of the water, produces fumes, or causes the water to bubble) immediately halt sample screening and contact the appropriate local authorities and local FBI WMD Coordinator.

5.8.3.4 If the sample does not react with water as described in Section 5.8.3.3, determine whether the sample dissolves or is miscible in the water.

5.8.4 Water Solubility and Reactivity Results

5.8.4.1 Although this test is primarily intended to define the solubility or miscibility of a sample, it also provides information about the reactivity of the sample with water. The solubility, miscibility and reactivity of a sample in water provide potential indicators of the class of CWA that may be present in a sample. Trends in the physical properties of classes of CWA are helpful in interpreting the results of water solubility/miscibility testing.

5.8.4.2 Generally, the G-type nerve agents are miscible in water, while the V-type nerve agents are moderately soluble in water. If the sample is an organic liquid that is soluble or miscible in water but not reactive, proceed with pH paper screening. All follow-on screening tests are performed using the aqueous sample solution.

5.8.4.3 Lewisite is soluble in and mildly reactive with water. As Lewisite is hydrolyzed, it forms a white precipitate, Lewisite oxide. This precipitate may form in the vial during solubility/miscibility testing. If there is a precipitate formed, test the pH of the sample solution; the hydrolysis of Lewisite will make the pH of the solution acidic (pH < 4). If the results of solubility/miscibility testing indicate a mildly reactive sample that produces a precipitate and an acidic sample solution, a presumptive positive for Lewisite should be reported. If the pH of the sample solution is between 4 and 8, proceed with potassium iodide-starch paper screening. If the results indicate that the pH is greater than 8, record the physical

properties of the sample and assess how to proceed with additional screening.

5.8.4.4 The blister agents are generally poorly soluble or insoluble in water, with the exception of Lewisite and phosgene oxime (CX). Mustard is denser than water and will settle to the bottom of the vial during testing. If the sample is an insoluble organic liquid that is denser than water, the sample may contain mustard. Proceed with the DB-3 dye test for alkylating agents.

5.8.4.5 If the sample reacts violently when added to water, screening should be stopped, and the lab director and FBI WMD coordinator should be contacted for direction.

5.8.4.6 If the sample dissolves or is miscible in water, perform the additional sample screening procedures described in Sections 5.10 to 5.12 (pH, starch iodide, and enzyme kit colorimetric tests).

5.8.4.7 If the sample is not soluble or miscible in water, the pH, starch iodide paper, and enzyme tests cannot be performed. Record the physical properties of the sample, as described in Section 5.14.

5.9 DB-3 Dye Test for Alkylating Agents

5.9.1 DB-3 Dye Test Procedures

5.9.1.1 Mix reagents

5.9.1.1.1 Reagent 1: Prepare a solution containing 4-(4-nitrobenzyl) pyridine (11.25 mg/mL) and mercury (II) cyanide (13.2 mg/mL) in methanol.

5.9.1.1.2 Reagent 2: Prepare a solution of potassium carbonate (600mg/ml) in water.

5.9.1.2 Test Sample

5.9.1.2.1 Wet a piece of chromatography grade silica gel paper with ~ 5 drops of Reagent 1.

5.9.1.2.2 Place the silica gel paper on a hot plate for 2 minutes.

5.9.1.2.3 Remove silica gel paper from the hot plate and wet it with 3-5 drops of the sample.

5.9.1.2.4 Return the silica gel paper with the sample to the hot plate for 1 minute.

5.9.1.2.5 Remove silica gel paper from the hot plate and wet it with ~10 drops of the sample.

5.9.1.2.6 Observe and document any color change on an AHRF Primary Sample Screening Results Form.

5.9.2 DB-3 Dye Test Results

5.9.2.1 Mustard gas (H) can be detected because of its reaction with a methanolic solution of DB-3 [4-(4' -nitrobenzyl)pyridine] in

the presence of a catalyst, mercuric cyanide. The product of this reaction then reacts with potassium carbonate to form an intense blue-purple color. This reaction is faster at e1evated temperatures. Since the DB-3 dye test is used as a general test for alkylating agents, any alkylating agent will produce a positive result.

5.9.2.2 If the DB-3 dye test results indicate that an alkylating agent is present in the sample, a presumptive positive for mustard should be reported.

5.9.2.3 If the results indicate an alkylating agent is not present in the sample, record the physical properties of the sample and assess how to proceed with additional screening.

5.10 pH Paper Test

5.10.1 pH Paper Test Procedures

5.10.1.1 pH paper can only be used on aqueous solutions.

5.10.1.2 If the sample is aqueous, place one drop of the liquid onto pH paper. Observe and record the results.

5.10.1.3 If the sample is a liquid or solid and is miscible/soluble in water, place one drop of the miscibility/solubility solution (see Section 5.8) onto pH paper. Observe and record the results on an AHRF Primary Sample Screening Results Form.

5.10.2 pH Paper Test Results

5.10.2.1 pH paper can only be used on aqueous solutions.

5.10.2.2 Generally, a pH value that is less than 4 and greater than 8 would suggest that a CWA is not a major constituent. However, this is not definitive since the production process and purification (or lack of) procedure may influence the pH.

5.10.2.3 If the results indicate that the pH is between 4 and 8, proceed with potassium iodide-starch paper screening (See Section 5.11).

5.10.2.4 If the results indicate that the pH is less than 4 or greater than 8, record the physical properties of the sample and assess how to proceed with additional screening since the enzyme test described in Section 5.12 will not be accurate.

5.11 Starch Iodide Test

5.11.1 Starch Iodide Paper Test Background

5.11.1.1 Starch iodide paper is used to test for the presence of oxidizing compounds. Oxidizers in the sample convert the iodide ions to elemental iodine to form triiodide and pentaiodide ions. These ions react with the starch to produce a blue complex. Therefore, development of a blue/purple color upon introduction of the sample indicates the presence of oxidizers.

5.11.2 Starch Iodide Paper Test Procedures

5.11.2.1 Potassium starch iodide paper can only be used on aqueous solutions.

5.11.2.2 If the sample is aqueous, place one drop of the liquid onto the potassium starch iodide paper. Observe and record the results.

5.11.2.3 If the sample is a liquid or a solid and is miscible/soluble in water, place one drop of the miscibility/solubility solution (See Section 5.8) onto the paper. Observe and record the results on an AHRF Primary Sample Screening Results Form.

5.11.3 Starch Iodide Paper Test Results

5.11.3.1 Potassium starch iodide paper can only be used on aqueous solutions.

5.11.3.2 If the paper develops a blue/purple color an oxidizer is indicated and is considered a positive result.

5.11.3.3 Since oxidizers such as bleach are used to decontaminate CWA, a positive result reduces the possibility that the sample contains CWA. However, the presence of strong oxidizers may still present a hazard that needs to be assessed prior to release of the sample to a fixed laboratory.

5.11.3.4 Strong oxidizers may cause rapid breakdown of the blue complex formed by the iodide ions and starch. This bleaching of the test paper can lead to false negative results, if the test is not read quickly. As the sample wicks up the paper, watch the leading edge of the liquid for a color change. If color change occurs record as a positive result.

5.11.3.5 If the results of potassium starch iodide paper are negative, no color change, proceed with the nerve agent enzyme ticket screening (See Section 5.12).

5.11.3.6 If the results of the potassium iodide-starch paper are positive, do not perform the nerve agent enzyme ticket screening because the presence of a strong oxidizer in solution will invalidate the results of the nerve agent enzyme ticket screening. Instead proceed to the optional FSP and IMS screens (See Section 5.13) and/or the visual inspection of the primary sample (See Section 5.14).

5.12 Primary Sample Screen for Nerve Agents

5.12.1 Nerve Agent Test Background

5.12.1.1 Screen the sample for nerve agents using a chemical and enzymatic indicator test kit.

5.12.1.2 Enzyme and chemical impregnated papers used in these kits will change color (typically to blue or green) in the absence of nerve agents.

5.12.1.3 Be sure to follow the manufacturer's instructions.

> WARNING! If analyses require direct physical contact with the sample or sample consumption, be sure to separate the amount of sample needed from the sample container. Do not introduce any foreign objects or materials into the sample container. Some of these kits contain chemicals that could contaminate the sample and compromise or complicate future analysis.

5.12.1.4 Observe and Record all results on an AHRF Primary Sample Screening Results Form.

5.12.2 Nerve Agent Screen Procedures for Liquid or Aqueous Samples

5.12.2.1 Place the smallest amount of sample or the solubility/miscibility solution to wet the entire surface (see Section 5.8) onto the enzyme impregnated paper contained in the detector.

5.12.2.2 Press the body of the detector into the detector holder so that the paper comes into contact with the chemical-impregnated paper.

5.12.2.3 A change in the color of the paper indicates that nerve agents <u>are not</u> present.

5.12.3 Nerve Agent Screen Procedures for Vapor Samples

5.12.3.1 Moisten the enzyme-impregnated paper with reagent water.

5.12.3.2 Place the paper into the opening of the sample container without touching the paper to any container surfaces.

5.12.3.3 Press the body of the detector into the detector holder so that the paper comes into contact with the chemical-impregnated paper.

5.12.3.4 A change in the color of the paper indicates that nerve agents <u>are not</u> present.

5.12.4 Nerve Agent Screening Results

5.12.4.1 The nerve agent enzyme ticket utilizes an acetylcholinesterase enzyme system to detect the presence of nerve agents. The test reagents consist of acetylcholinesterase immobilized on a filter paper spot and the substrate indoxyl acetate. The nerve agents compete with the substrate for the active site of the enzyme. In the absence of nerve agent, acetylcholinesterase converts indoxyl acetate into 3-hydroxyindole, a compound that is blue in color. If either G or V agent is present it will tie up the enzyme, which will then not be available to react with indoxyl acetate to form the blue color.

5.12.4.2 Since the performance of the nerve agent enzyme ticket depends on the activity of acetylcholinesterase, strong oxidizers, low or high pH, organo-phosphate pesticides, and other acetylcholinesterase inhibitors may produce false positive results. For this reason, aqueous samples for which previous

screening results indicate high or low pH or the presence of strong oxidizers should not be screened with the nerve agent enzyme ticket.

5.12.4.3 If the nerve agent enzyme ticket results indicate that an acetylcholinesterase inhibitor is present in the sample (no color), a presumptive positive for nerve agent should be reported. If the results indicate that nerve agent is not present in the sample (blue), record the physical properties of the sample and assess how to proceed with additional screening.

5.13 Primary Sample Optional Screen using IMS and/or FSP

5.13.1 Optional IMS and FSP Screening Procedures

5.13.1.1 If additional information is needed or requested, an aliquot of sample can be removed to a Class II (Type A or B) biosafety cabinet for screening using the ion mobility spectrophotometer (IMS) and/or Flame Spectrophotometer (FSP).

5.13.1.2 A small sample aliquot should be placed onto filter paper or a watch glass. Due to instrument and contamination concerns, this equipment should not be used or stored in the glove box.

5.13.1.3 Follow the procedures described in Section 4.1 for sample screening using the IMS or FSP.

5.13.1.4 Observe and Record all results on an AHRF Primary Sample Screening Results Form.

5.13.2 Ion Mobility Spectrophotometer (IMS) Results

5.13.2.1 The IMS contains a library of specific compounds. If the IMS library contains CWAs, the detector should display the name of the CWA detected. Since the result is based on time of flight of an ion, similar ions from related compounds may produce false positives. In addition, IMS screening is influenced by changes in environmental sampling conditions (temperature, humidity, etc.), which could produce anomalous results. Therefore, all results from IMS screening should be treated as presumptive and should only be considered within the context of other screening results.

5.13.3 Flame Spectrophotometer (FSP) Results

5.13.3.1 The FSP is capable of detecting the presence of specific elements produced during the thermal decomposition of vapor and aerosol samples. The specific elements detected are based on the types of filters installed in the unit. For the purposes of general CWA screening in the AHRF, the AHRF FSP is equipped with filters for sulfur and phosphorus.

5.13.3.2 Sulfur is generally associated with blister agents, the FSP display indicates the presence of sulfur-bearing compounds as

bars of H, with the number of bars indicating the degree of contamination.

5.13.3.3 Phosphorus is generally associated with nerve agents, the FSP display indicates the presence of phosphorus-bearing compounds as bars of G.

5.13.3.4 V-type nerve agents contain both sulfur and phosphorus, the FSP will display bars of H and G when they are present.

> WARNING! Since the FSP is only screening for sulfur and phosphorus, any volatile compounds that bear these elements will produce a positive result.

5.14 Visual Inspection of the Primary Sample

5.14.1 Record the physical properties of the sample (e.g., color, texture, composition) on the AHRF Primary Sample Screening Results Form.

5.15 Review Results and Documentation of Initial Screening

5.15.1 Review the AHRF Primary Sample Screening Results Form to ensure that all screening results have been reported.

5.15.2 Consult with the receiving laboratory to determine whether the information provided by the sample COC, field report, and AHRF screening is considered sufficient to provide an assessment of risk to the receiving laboratory. If the information is considered to be sufficient, prepare the sample, field report, COC, and facility screening report forms for transport to the laboratory. The outside of all sample containers should be decontaminated with a 10% bleach solution and rinsed with deionized or distilled water before leaving the glove box. Samples that are removed from the glove box should be stored in a biological safety cabinet until they are shipped from the AHRF.

5.15.3 If additional screening is needed or requested, proceed with Section 6.0.

6.0 Additional Chemical Screening of the Primary Sample

If the supervising laboratory director feels further screening is needed, reevaluate results and determine the next course of action. An example of additional screening is outlined in this section, but ultimately the supervising laboratory director and AHRF personnel will determine what further screening will be done.

Screen the sample for CWAs and chemical compounds using colorimetric chemical indicator paper. Colorimetric chemical indicator paper can be obtained commercially in single patches of eight small squares that change color when they come into contact with their target chemical. One of the indicator papers should be M8 paper to detect the presence of nerve or blister (V, G, and H) agents. The other indicator papers should identify chlorine, pH, fluoride, cyanide, sulfide, arsenic, and oxidizers. Draeger tubes also may be used as an option for assessing sample headspace for target chemical agents and compounds.

6.1 For Liquid or Aqueous Samples

6.1.1 Place one drop of sample onto each of the colorimetric indicator papers. To avoid spillage, the indicator papers may be placed inside a small container (e.g., petri dish, concave observation dish, wide beaker). The reaction time necessary to produce a color change if a target compound is present should be instantaneous.

6.1.2 Observe the color of the indicator papers and record results on the AHRF Primary Sample Screening Results Form.

6.2 For Solid Samples

6.2.1 Hold the colorimetric indicator papers inside a sealed containment bag near the open end of the sample container for approximately one minute. Do not allow the indicator papers to come into contact with the sample.

6.2.2 Observe the color of the indicator papers, and record results on the AHRF Primary Sample Screening Results Form.

6.2.3 Remove the colorimetric indicators from the bag.

6.2.4 If no color change occurs, place the smallest visible amount of the solid sample onto each paper that did not undergo a color change. To avoid spillage, the indicator paper may be placed inside a small container (e.g., petri dish, concave observation dish, wide beaker).

6.2.5 Observe if any color change occurred. If the indicator papers do not change color, wet the sample on top of these indicator papers with a few drops of reagent grade water. Wait approximately one minute. Observe the color of the indicator papers and record results on the Sample Screening Results Form.

7.0 Shipment to the Receiving Laboratory

7.1 AHRF Screening Results Forms Review

7.1.1 Review the screening results forms from all phases of the AHRF screening.

7.1.1.1 All results should be legible, verifiable, and contain appropriate measurement units.

7.1.1.2 Ensure that the results of all AHRF screening procedures have been recorded and signed by the appropriate screening technician.

7.1.2 Compile finalized forms into a single AHRF Screening Report.

7.1.3 Ensure that all screening technicians and the AHRF Coordinator sign the final report, including date and time of signature.

7.2 Contacting Authorities/Receiving Laboratory

7.2.1 Consult the agency with ownership of the sample (e.g., Police, Fire Department, Emergency Responders, FBI), appropriate local authorities and the local FBI WMD Coordinator to determine fate of the sample based on the AHRF screening results. NOTE: The AHRF does not screen for biological hazards. Thus, samples cannot be sent to a laboratory that is not prepared to receive samples that may contain a biological hazard unless the sample has been deemed to be safe by a biological laboratory. Similarly, if field or AHRF screening indicates the presence of a hazard that a biological laboratory is not capable of receiving, this hazard (chemical, radiological, or explosive) can often be mitigated by transporting a small aliquot of the sample to the biological laboratory. If the biological laboratory director agrees, a small sample aliquot (e.g., 0.5 mL or 500 mg) and/or a sample swab may be sent to the laboratory even if it contains a chemical, radiological, or explosive hazard.

7.2.1.1 If samples are to be transported to a receiving laboratory for further analysis, AHRF staff should contact the receiving laboratory to ensure the laboratory is capable of receiving samples that contain hazards that have been identified during field and AHRF screening. Sample reports and screening results forms should be delivered to the receiving laboratory and the laboratory manager consulted prior to sample shipment.

7.2.1.2 If the samples do not need any further analysis, AHRF staff should contact the agency with ownership of the sample to coordinate destruction or transfer of the sample back to that agency.

7.3 Package Preparation and Shipment

7.3.1 Decontaminate the outside of the sample containers with a bleach solution (e.g., 10%), rinse with deionized or distilled water, and provide a final

rinse with ethanol or isopropyl alcohol before moving the samples from the glove box to the biological safety cabinet (See Appendix A and B).

7.3.2 Package samples for shipment to the receiving laboratory according to U.S. Department of Transportation Hazardous Materials Transportation Act (HMTA) and Hazardous Materials Transportation Safety Act (HMTSA) requirements at 49 CFR parts 171 through 177.

7.3.3 Place AHRF Sample Receipt and Screening Report Forms, sample COC, and the sample field report into a transparent protective wrap. Adhere the package to the sample transport container.

7.3.4 Stored the packaged samples in the biological safety cabinet or sample exit interlock until they are shipped from the AHRF.

7.3.5 Prior to relinquishing custody of the sample to the transporting courier, ensure courier credentials are carefully established, confirmed, and documented.

8.0 Glossary of Terms

Alpha Radiation, Emission, or Particles: Alpha radiation is made up of positively charged particles composed of two neutrons and two protons. It is easily blocked by clothing, skin, or even significant quantities of air. Alpha emitters are generally only hazardous to humans when inhaled or ingested.

Beta Radiation, Emission, or Particles: Beta radiation is made up of negatively charged particles equivalent to an electron. These particles can be blocked by a sturdy solid material like wood or metal. Beta particles are generally hazardous when inhaled, ingested, or when in direct contact with the skin or eyes.

Bleaching Station: Chemical fume hood or equivalent environmental enclosure HEPA and carbon filters designed for use with CWAs.

Blister Agents (also referred to as mustard agents): The wounds caused by these agents resemble burns and blisters. Blistering agents cause severe damage to the eyes, respiratory system, and internal organs. Common blistering agents are mustard (HD), nitrogen mustard (HN-1, HN-2, HN-3), and Lewisite (L).

Blood Agents: Cyanide-based agents that inhibit the metal-containing enzymes, most notably iron in the blood (hemoglobin), preventing cell respiration from occurring. Common examples are hydrogen cyanide and cyanogen chloride.

Biosafety Cabinet: Minimum Class II Type A2 with HEPA and carbon filters designed for use with CWAs.

Chemical Warfare Agents (CWAs): The United Nations (UN) Chemical Weapons Convention defines a CWA as "... any chemical which, through its chemical effect on living processes, may cause death, temporary loss of performance, or permanent injury to people and animals." Nerve agents and blister agents are the two classes of CWAs that have been most widely manufactured and used for military purposes.

Choking Agents: Chemical agents that attack lung tissue, primarily causing pulmonary edema. Common choking agents are chloropicrin (PS), chlorine (Cl), phosgene (CG), and diphosgene (DP).

Colorimetric Indicator: A colorimetric indicator is a detector that changes color when it comes in contact with a substance it was designed to detect. These indicators typically require a minimum amount of the material to change color. They are usually not capable of determining the quantity or concentration of the substance present. Some colorimetric indicators are prone to false positives and non-detects. Some colorimetric indicators are embedded into a strip of paper, and are often referred to as indicator papers.

Combustible Gas Indicator: Detects and measures concentrations of combustible gases or vapors in the air. These instruments typically can be used in the immediate environment or, with sampling lines and probes, draw samples from remote areas.

Containment Bag: An airtight sealable bag that envelope a primary sample container.

Direct Read: A direct read instrument is an instrument that provides a measurement, either as a meter needle deflection or numerical readout, that is instantly usable. The measurement does not require any calculations or conversions, but may require the use of a scale factor multiplying the reading as determined by a selector switch position. By example, the micro R meter reads directly in uR/hr. The meter face is from 0 to 5 and the switch settings are x1, x10, x100, and x1000, thus providing readings from 0 - 5 uR/hr to 0 - 5000 uR/hr.

Flame Spectrophotometer (FSP): A flame spectrophotometer uses a burner (often a hydrogen source) to heat a sample, allowing the elements to produce their characteristic spectral emissions for detection. FSPs used for chemical warfare agents are set to detect the emissions of sulfur and phosphorous. This instrument provides a rapid analysis in a few seconds. It will detect any compound containing sulfur or phosphorous, in addition to chemical warfare agents.

Fume Hood: Chemical fume hood with HEPA and carbon filters designed for use with CWAs

G Agents: A series of organo-phosphorous nerve agents that were labeled "G" because they were first manufactured in Germany. The common G agents are GA (Tabun), GB (Sarin), GD (Soman), GE, and GF (Cyclohexylsarin).

Gamma Radiation, Emission, or Rays: Gamma radiation is electromagnetic energy from the decay of an isotope. This energy can be blocked with dense material (e.g., lead or dense concrete). Gamma rays are emitted from the sun and the earth, and are a daily part of life. Excessive or prolonged elevated exposure to gamma rays is known to cause cancer, and extreme exposure can cause death. High levels of gamma radiation can be detected through a sample container or a series of containers and overpack materials.

Glove Box: Class III biosafety cabinet with HEPA and carbon filters designed for use with CWAs.

H Agents: A class of chlorinated blister agents. H agents include mustard gas (HD) and nitrogen mustards (HN-1, HN-2, and HN-3).

Indicator Paper: Indicator paper is a strip of paper that contains reagents that cause the paper to change color when it comes into contact with the substance it was designed to detect. There are many different types of indicators. Some indicator papers can change to many different shades of a particular color, that can be used to determine a very rough concentration of a target substance.

Ion Mobility Spectrometer (IMS): An ion mobility spectrometer determines the presence of a substance by placing a positive charge on each molecule that enters the IMS, and then measuring

its molecular mass-to-charge ratio. An IMS will identify molecules that have a corresponding mass-to-charge ratio programmed into the instrument's database. This instrument can identify specific compounds, but it is unable to quantify the amount present.

Nerve Agents: Nerve agents affect the transmission of nerve impulses in the nervous system. Most nerve agents are organo-phosphorous compounds. These compounds are stable, easily dispersed, and have highly toxic and rapid effects with inhalation or skin contact. Common nerve agents are Tabun (GA), Sarin (GB), Soman (GC), Cyclohexylsarin (GF), and VX.

Non-Standard Butyl Gloves: Butyl rubber gloves that are 7mil thick.

PPE - Personal Protective Equipment: Equipment that protects the human body from hazards (e.g., chemical, biological, radiological, explosive, or physical). Gloves, safety goggles, steel toed boots, aprons, Tyvek suits, face shields, and respirators are examples of different types of PPE.

Photoionization Detector (PID): A PID detects, but cannot differentiate between most organic compounds. A high energy bulb knocks electrons off of molecules that enter the PID, making them positively charged. These positively charged molecules are then pumped towards a detector. The movement of the positively charged molecules creates a current. The more charged molecules that are present, the larger the current. A measurement of the current determines the magnitude of the reading. These instruments are typically sensitive, but not selective. The readout is usually in parts per billion, but the reading is often very inaccurate.

Primary Sample Container: The primary sample container holds and comes into direct contact with the sample. Often, for potentially hazardous samples, there are two primary containers. Sometimes the inner container is glass and the outer is plastic. Sometimes there is one glass or plastic container inside a sealed air tight containment bag. A primary container never holds more that one sample.

Scan Measurement: A measurement taken with an instrument that is held over a sample. The measurement does not consume or destroy any of the sample. By example, the alpha beta survey instrument reads in cpm (counts per minute) which must be converted to dpm (disintegrations per minute).

Transport Container: The sample transport container is the outermost container that is received from the carrier at the AHRF. Some government agencies refer to this as the "overpack." Often it is in the form of a cooler or trunk. A single transport container may hold multiple samples.

V Agents: V agents are one set of persistent nerve agents (several days are required for decomposition). The first V agent was synthesized in 1954 by the British. VX, VE, VG, VM, and V-gas are the most common V agents.

Volatile Organic Compounds (VOCs): Organic molecules with low boiling points that will spontaneously evaporate in the air. This evaporation may not necessarily be rapid.

Wipe Sample: A sample that is made up of cloth (e.g., cotton or Dacron) or paper, that is wiped over a substance or surface to be sampled removing the loose layer of material, whether seen or not, off the surface of the object. This is most often used to sample a film or particulate covering a surface.

9.0 Attachments

9.1 Attachment 1: Personal Protection Equipment (PPE)

All Hazards Receipt (AHR) Facility staff should be trained in Occupational Safety and Health Administration (OSHA) requirements for hazardous waste operations and emergency response at 29 CFR 1910.120 or 29 CFR 1926.65, and should be familiar with a Health and Safety Plan that is specific for the Facility. AHR Facility staff also should be familiar with U.S. Department of Transportation Hazardous Materials Transportation Act (HMTA) and Hazardous Materials Transportation Safety Act (HMTSA) requirements at 49 CFR parts 171 through 177 for packaging and transporting hazardous materials.

Information obtained during the facility sample receipt and screening processes can be used to make decisions regarding the level of protection needed and to ensure Facility staff has proper personal protective equipment (PPE). PPE that will protect employees from the hazards and potential hazards they are likely to encounter as identified during sample receipt and screening should be selected and used. OSHA standards at 29 CFR 1910.120 include the following:

- PPE selection is based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

- The level of protection provided by PPE selection shall be increased when additional information on site conditions indicates that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure limits and published exposure levels for hazardous substances and health hazards.

- The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

Specific guidance for selection of PPE is provided in Appendix B to 29 CFR 1910.120. The minimal amount of PPE that is considered to be necessary for performing AHR Facility activities includes two pairs of nitrile gloves, eye protection, face mask, and coverings. Equipment also should be available such that facility personnel can increase the PPE, if necessary. Information regarding AHR Facility PPE is listed below. Information regarding the hazards of contaminants that facility personnel may encounter and additional resources that should be consulted also are provided.

Minimum PPE that Should Be Used by All Hazards Receipt Facility Personnel (Level D)

Level D protection is used when the atmosphere contains no known hazard, and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals. Although Level D lists the use of hard hats and face shields, it is anticipated that these will not be needed during routine facility operations.

- Coveralls (e.g., 20 Mil Vinyl PVC Apron)
- 2 pairs of nitrile gloves (e.g., Nitrile Gloves compliant with 21 CFR, preferably at least 15 Mil)
- Boots/shoes (Chemical-resistant steel toe and shank, and disposable outer boot/shoe covers
- Safety glasses or chemical splash goggles (e.g., ANSI Z87.1-1989, SEI certified eye protection goggles or visor)
- Escape mask - close at hand

Nitrile gloves should be changed in between each sample or every five minutes of sample handling, whichever occurs first.

Additional PPE for Potential Use at the All Hazards Receipt Facility

Level C
- Full-face or half-mask, air purifying respirators [National Institute for Occupational Safety and Health (NIOSH)-approved]
- Hooded chemical-resistant clothing (overalls, two-piece chemical-splash suit, disposable chemical-resistant overalls)
- Level D protection

Level B
- Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH-approved)
- Level C protection

Potential Hazards that May Be Encountered by All Hazards Receipt Facility Personnel

Information regarding potential hazardous exposures is taken from the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, prepared by NIOSH, OSHA, U.S. Coast Guard, and USEPA.

Radiation

Radioactive materials emit one or more of three types of harmful radiation: alpha, beta, and gamma. Alpha radiation has limited penetration ability and is usually stopped by clothing and the outer layers of the skin. Alpha radiation poses little threat outside the body, but can be hazardous if materials that emit alpha radiation are inhaled or ingested. Beta radiation can cause harmful “beta burns” to the skin and damage the subsurface blood system. Beta radiation is also

hazardous if materials that emit beta radiation are inhaled or ingested. Use of protective clothing, coupled with scrupulous personal hygiene and decontamination, affords good protection against alpha and beta radiation.

Gamma radiation easily passes through clothing and human tissue and can cause serious permanent damage to the body. Chemical-protective clothing affords no protection against gamma radiation itself; however, use of respiratory and other protective equipment can help keep radiation-emitting materials from entering the body by inhalation, ingestion, injection, or skin absorption.

Explosion and Fire

There are many potential causes of explosions and fires, including:

- Chemical reactions
- Ignition of explosive or flammable chemicals
- Ignition of materials due to oxygen enrichment
- Agitation of shock- or friction-sensitive compounds
- Sudden release of materials under pressure

Explosions and fires may arise spontaneously. However, more commonly, they result from site activities, such as moving drums, accidentally mixing incompatible chemicals, or introducing an ignition source (such as a spark from equipment) into an explosive or flammable environment. Explosions and fires not only pose the obvious hazards of intense heat, open flame, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals. Keep all potential ignition sources away from an explosive or flammable environment; use non-sparking, explosion-proof equipment; and follow safe practices when performing any task that might result in the agitation or release of chemicals.

Chemical Exposure

Hazardous chemicals can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage at the point of contact or can act systemically, causing a toxic effect at a part of the body distant from the point of initial contact.

For either chronic (low concentrations over a long period of time) or acute (high concentrations over a short period of time) exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects such as cancer or respiratory disease may not manifest for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

An important exposure route of concern at a hazardous waste site is inhalation. The lungs are extremely vulnerable to chemical agents. Even substances that do not directly affect the lungs may pass through the lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some toxic chemicals present in the atmosphere may not be detected by human senses, e.g., they may be colorless and their toxic effects may not produce immediate symptoms. Respiratory protection is, therefore, extremely important if there is a possibility that the work site may contain such hazardous substances.

Direct contact of the skin and eyes by hazardous substances is another route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Biological Hazards

Like chemical hazards, etiologic agents may be dispersed in the environment via water and wind. Protective clothing and respiratory equipment can help reduce the chances of exposure. Thorough washing of any exposed body parts and equipment will help protect against infection.

9.2 Attachment 2: Example Sample Receipt Form

A Sample Receipt form creates an accurate written record of the information gained through the interview process with the courier. An example Sample Receipt form is provided in this attachment.

All Hazards Receipt Facility
Example Sample Receipt Form

Name of Sample Receipt Personnel: _____

Date: _____ Time: _____ A.M. / P.M.
(mm/dd/yyyy)

	Yes	No	Comments
Does the sample have a corresponding Chain of Custody (COC) form?	☐	☐	_____
Does the sample have a corresponding field report or emergency sample form?	☐	☐	_____

Government Agency performing field evaluation: _____

NOTE: *If suspected of being an explosive, pressurized or dispersal device, STOP, and contact qualifiifed bomb specialist. If sample transport container is suspected to contain an explosive device or explosive or shock-sensitive waste as determined by visual inspection, seek specialized assistance before further handling.*

1. Review, Verify, and Update the COC

a) Does the COC contain the following information and is it correct and up-to-date?

	Yes	No	Comments
· Date, time, and location of sample collection	☐	☐	_____
· Number of samples collected and transported	☐	☐	_____
· Identification of sample collector	☐	☐	_____
· Contact information for an incident commander	☐	☐	_____
· The names of any person or persons handling the sample	☐	☐	_____
· The time and location of any transfer of sample possession	☐	☐	_____

2. Interview Technician Delivering Sample

a) Technician Name: _____
(please print)

b) Government Agency Affiliation (*NOTE: If unknown, contact approving official*): _____

c) Date of Delivery: _____ Time: _____ A.M. / P.M.
(mm/dd/yyyy)

d) Technician Signature: _____

e) Check the technician's government-issued picture ID against signature ☐

	Yes	No	Comments
f) Did the technician sign the Chain of Custody (COC) form?	☐	☐	_____

- Technician first received possession of the sample on _____ at _____ A.M. / P.M.
Date (mm/dd/yyyy) *Time*

- Location where technician first obtained possession of sample _____

g) Sample condition and/or containment when technician first had possession of the sample: _____

h) Report Results To (provide 24/7 contact information):

_____ _____
Name *Phone number*

_____ _____
Name *Phone number*

i) Comments or observations regarding environmental conditions or sample transport: _____

_____

	Yes	No	Comments
j) Does the above information match the information in the COC form?	☐	☐	_____

3. Review and Evaluate the Field Report or Emergency Sample Form

a) Does the field report or emergency sample form contain the following information?

	Yes	No	Comments
· Date, time, and location of sample collection	☐	☐	
· Sample identification number	☐	☐	
· Environmental and/or human health impacts	☐	☐	
· Name(s) of field personnel collecting the sample	☐	☐	
· Were field tests performed?	☐	☐	
If yes, does the form indicate:			
Types of tests performed	☐	☐	
Equipment used	☐	☐	
Date and time of testing	☐	☐	
Results of tests	☐	☐	
Persons performing tests	☐	☐	
Name(s) of personnel collecting the sample	☐	☐	

4. Inspect Sample Container Label

	Yes	No	Comments
a) If the transport container has a label or custody seal, does the date, time, and location of sample collection match the information on the COC form?			
b) If the transport container has a label or custody seal, does the date, time, and location of sample collection match the information on the field report or emergency sample form?			

c) Does each sample transport container label contain the following information?

	Yes	No	Comments
· Sample description (location and type):			
· Time/date taken or found:			
· Field technician initials:			
· Sample identification code or number:			

d) Examine the transport container for additional placards, labels, or marks indicating that the contents are hazardous.

	Yes	No	Comments
· Any reported associated risks?			

NOTE: *Unlabeled sample transport containers should be assumed hazardous until the contents are further screened or evaluated.*

5. Visual Inspection of Sample Transport Container

NOTE: *Sample transport containers must not be opened during any sample receipt activities, including during visual inspection of container.*

a) Examine the sample transport container and the field report form for suspicious indicators.

	Yes	No	Comments
· Protruding wires	☐	☐	
· Strange odors (*Odor should be evident. **DO NOT** sniff the sample container!*)	☐	☐	
· Oily stains, discoloration, or crystallization	☐	☐	
· Excessive tape or string	☐	☐	
· Does it look like a device (e.g., explosive or pressurized container)?	☐	☐	

b) Visually inspect the sample container and perform the following tasks and note observations.

· Description of the sample as determined by inspection _____

· Color _____

· Approximate volume or size/weight _____

· Check for the presence of sediments or foreign material ☐ _____

· Photograph sample transport container (number taken) ☐ _____

	Yes	No	Comments
· Is the transport container properly sealed?	☐	☐	
· Is the container damaged, bulging, discolored, or leaking?	☐	☐	
· Is any unusual or unexpected field contamination on the container (e.g., bright colored substances, crystalline deposits, liquid)?	☐	☐	

6. Identify Sample by Type

Identify sample by known and unknown sources: *(check one)*

Known source: ☐
(collected by a field technician or remote sensing/monitoring equipment and controlled in sample container)

Unknown source: ☐
(discovered by field technician or agent, source unidentified, placed in containment bag or secondary transport container at scene)

	Yes	No
If the source is known, was sampling equipment or primary collection container supplied by field collector or appropriate government agency?	☐	☐

Use information obtained from the COC, field report, interview with technician, and visual inspection to identify the sample by type and source.

Identify sample type: *(check only one)*

		Notes/Comments
Water (e.g., groundwater, drinking water, stream, reservoir, other water body)	☐	
Soil (e.g., surface, sub-surface)	☐	
Liquids	☐	
Solids (e.g., powder)	☐	
Air filters (e.g., filters from field sampling equipment, automotive vehicles, equipment operating in direct area, canisters, tubes, etc.)	☐	
Suspicious packages	☐	
Gas bombs or canisters (e.g., vacuum filled, pressurized containers)	☐	

Notes/Comments: _____

_____

_____ _____ _____ AM / PM

Signature of Sample Receipt Personnel *Date (mm/dd/yyyy)* *Time*

_____ _____ _____ AM / PM

Signature of Approving Official *Date (mm/dd/yyyy)* *Time*

9.3 Attachment 3: Example Chain of Custody Form (COC)

A Chain of Custody (COC) form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. Chain of Custody is used and required, without exception, for the tracking and recording of on-site or off-site sample collection, transport, and analysis. A COC form creates an accurate documented record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. An example COC form is provided in this attachment.

A COC form accompanies each sample or group of samples as custody of the sample(s) is transferred from one custodian to another. One copy of the form is retained by the original sample collector, and another is obtained by each receiving laboratory. Each laboratory or facility representative who accepts an incoming sample shipment signs and dates the COC record. It is the laboratory or facility's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis. Sample custodians are responsible for initiating, maintaining, or completing COC tracking. A sample custodian is the person responsible for the custody of a sample or samples at a particular time, until custody is transferred to another person (and so documented), who then becomes the new custodian. A sample is under a person's custody if:

- it is in that person's possession
- it is in that person's view, after being in that person's physical possession
- it was in that person's physical possession and then he/she locked it up to prevent tampering
- that person placed it in a designated and identified secure area

Note: Common carriers usually will not accept responsibility for handling Chain of Custody forms. This often necessitates packing the COC record in the shipping container (enclosed with other documentation in a re-sealable plastic bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

Example Chain of Custody Form

Sample Owner and Contact Info:		**Primary Sample Collector (Print)**	**Primary Sample Collector (Signature)**
Sample Type 1.Surface Water 7.Sludge 2.Ground Water 8.Waste 3.Potable Water 9.Air 4.Wastewater 10.Powder 5.Leachate 11.Petroleum 6.Soil/Sediment 12. Other:	**Sample Collector(s) Affiliation** **(If different from Sample Owner)**	**Sample Collector(s) Print**	**Sample Collector(s) Signature**
		Sample Collector(s) Print	**Sample Collector(s) Signature**
	Comments:		

Sample ID Number	**Sample Type**	**Date 20__**	**Time**	**Composite**	**Grab**	**Site Location/Description**	**Original Quantity**	**Field Chemical Screen**	**Field Explosive Screen**	**Field Radiation Screen**	**Field Biological Screen**	**Description of Packaging Container(s) and Preservation (if added)**

Relinquished By: (Print Name and Affiliation)	Date/Time	Received by: (Print Name and Affiliation)	Relinquished By: (Print Name and Affiliation)	Date/Time	Received By: (Print Name and Affiliation)
Sign:		Sign:	Sign:		Sign:
Relinquished By: (Print Name and Affiliation)	Date/Time	Received by: (Print Name and Affiliation)	Relinquished By: (Print Name and Affiliation)	Date/Time	Received By: (Print Name and Affiliation)
Sign:		Sign:	Sign:		Sign:

9.4 Attachment 4: Example Facility Screening Results Forms

9.4.1 Transport Container Screening Results Form

All Hazards Receipt Facility Example Transport/Secondary Container Screening Form

Date (mm/dd/yyyy)_____
Customer Sample Identification Number _____ AHRF Sample Identification Number_____

Screening Personnel #1_____ #2_____ #3_____ #4_____

Explosives Device Screen

Are suspicious indicators present?

Protruding wires	YES	NO
Rigidness or Bulkiness	YES	NO
Excessive Tape or String	YES	NO
Other:		
Other:		
Other:		

If yes, immediately isolate sample and contact the bomb squad.

X-Ray Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**
Gamma Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**
Deemed Inert by Certified Bomb Technician?	YES	NO	**Comments:**

Radiation Screen

Gamma Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**	Above Threshold	Below Threshold
Direct Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**	Above Threshold	Below Threshold
Wipe Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**	Above Threshold	Below Threshold

Chemical Screen

Unknown substance on container?	YES	NO	**Comments:**
Oily stains	YES	NO	**Comments:**
Discoloration	YES	NO	**Comments:**
Crystallization	YES	NO	**Comments:**
Powders	YES	NO	**Comments:**
Liquids	YES	NO	**Comments:**
M8 Paper Test Performed	YES	NO	**Results:**

9.4.2 **Primary Sample Container Screening Results Form**

All Hazards Receipt Facility Example Primary Container Screening Form

Date (mm/dd/yyyy)_____
Customer Sample Identification Number _____ AHRF Sample Identification Number_____

Screening Personnel #1_____ #2_____ #3_____ #4_____

Optional IMS and FSP Screen

IMS Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**
FSP Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**

Visual Inspection

Sample Integrity	Good	Poor		**Container Type**			
Description				**Unusual or Unexpected Contamination on Container**	YES	NO	
Sediment Present	YES	NO		**Suspicious Indicators**	YES	NO	
Color				**Temperature**			
Volume or Size/weight				**Photograph**	YES	NO	
Glove Box Transferable	YES	NO		**Greater than 2mg or mL**	YES	NO	

Radiation Screen

Direct Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**	Above Threshold	Below Threshold
Wipe Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results:**	Above Threshold	Below Threshold

Explosives Screen

Colorimetric Wipe Test Performed?	YES	NO	**Comments:**
Crystallization Present	YES	NO	**Comments:**

Chemical Screen

Is there any visual signs of Leakage?	YES	NO	**Comments:**
M8 Paper Test	POS	NEG	**Comments:**

Continuation of Screening Procedures Assessment

Is it Suitable to Transfer Entire Primary Sample Container to the Glove Box?	YES	NO	**Comments:**
Is there greater than 2 grams/milliliters of sample present	YES	NO	**Comments:**
Is there enough information to transfer the sample to a fixed site laboratory?	YES	NO	**Comments:**

9.4.3 **Primary Sample Screening Results Form**

All Hazards Receipt Facility Example Primary Sample Screening Form

Date (mm/dd/yyyy)_____
Customer Sample Identification Number _____ AHRF Sample Identification Number_____

Screening Personnel #1_____ #2_____ #3_____ #4_____

Combustible Gases and VOCs Screen

CGI Screen Performed? Instrument Model: S/N:	YES	NO	**Results** POS NEG	**Comments**
PID Screen Performed? Instrument Model: S/N:	YES	NO	**Results** POS NEG	**Comments**

Radiation Screen

Direct Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results** Above Threshold Below Threshold	**Comments**
Wipe Alpha and Beta Screen Performed? Instrument Model: S/N:	YES	NO	**Results** Above Threshold Below Threshold	**Comments**

Explosives Screen

Thermal Susceptibility Test Performed?	YES	NO	**Results** POS NEG	**Comments**

Chemical Screens

Thermal Susceptibility Test Performed?	YES	NO	**Results**	**Comments**	
			POS		
			NEG		
M8 Paper Test Performed?	YES	NO	**Results**	**Comments**	
			POS		
			NEG		
Water Solubility and Reactivity Test Performed?	YES	NO	**Results**	**Comments**	
			REACTS		
			INSOLUBLE		
			IMMISCIBLE		
			MISCIBLE		
			SOLUBLE		
DB-3 Dye Test Performed?	YES	NO	**Results**	**Comments**	
			POS		
			NEG		
pH Paper Test Performed?	YES	NO	**Results**	**Comments**	
			4-8		
			<4 or >8		
Starch Iodide Test Performed?	YES	NO	**Results**	**Comments**	
			POS		
			NEG		
Nerve Agent Test Performed?	YES	NO	**Results**	**Comments**	
			POS		
			NEG		
Colorimetric Indicator Paper Additional Screens Needed?	YES	NO	**Test**	**Result**	**Comments**

Optional IMS and FSP Screen

IMS Screen Performed? Instrument Model: S/N:	YES	NO	**Results** POS NEG	**Comments**
FSP Screen Performed? Instrument Model: S/N:	YES	NO	**Results** POS NEG	**Comments**

Visual Inspection

Physical Description			
Color			
Composition			
Texture			
Photograph Taken	YES	NO	
Other:			
Other:			
Other:			
Other:			

Initial Screening and Shipment Assessment

Is there sufficient information to provide an assessment of risk to the receiving laboratory?	YES	NO	**Comments:**
Is there an appropriate laboratory to transfer the sample to?	YES	NO	**Comments:**
Packaged and Decontaminated the exterior of all transport containers.	YES	NO	**Comments:**
Chain of Custody Prepared and Signed	YES	NO	**Comments:**

10.0 Appendices

10.1 Appendix A: Example IOP for Work Area Cleanup and Decontamination
10.2 Appendix B: Example IOP for the Titration of Bleach and HTH
10.3 Appendix C: Example SOP for AHRF BL-2/BL-3 Operations Lab Safety
10.4 Appendix D: Example Laboratory Chemical Hygiene Plan
10.5 Appendix E: Sample Collection Guidance for Unknown Contamination Events
10.6 Appendix F: References and Additional Resources

10.1 Appendix A: Example IOP for Work Area Cleanup and Decontamination

TITLE: WORK AREA CLEANUP AND DECONTAMINATION PROCESS

Prepared by: Nicole G. McKew, EC/B FAC

Date Prepared: 14 March 06

Reviewed By:

MELISSA A. MULLAN, Date
Quality Manager, EC/B FAC

Approved By:

STEPHEN E. LAWHORNE, Date
Chief, EC/B FAC

ISSUE DATE: SEP 2 1 2006

A. PURPOSE-SCOPE

This protocol is intended to identify procedures for decontaminating work surfaces and supplies prior to and after working with forensic samples that are potentially contaminated with chemical and/or biological warfare agents. This protocol is not intended for decontamination and cleanup of large spills or to eliminate gross contamination. Rather, it is intended to account for trace contamination that may occur during the processing of forensic samples and to cleanup work areas and supplies between samples. This document describes methodologies to be used for biological safety cabinets, chemical fume hoods, glove boxes, work surfaces and ancillary supplies. Procedures specified in this document can be utilized in both pre-deployment areas and for the deployed environment.

Note: Verification of these procedures for effectively decontaminating surfaces, especially those contaminated with spores, has not been completed; further action may be required.

B. REAGENTS AND MATERIALS

1. Reagents

   1.1. 5% Sodium Hypochlorite (Household Bleach)
   1.2. White Vinegar (used to stabilize bleach to pH 6-7)
   1.3. Denatured 95% Ethanol (ETOH) or 70 - 85% Isopropyl Alcohol (IPA)
   1.4. Deionized Water (DI Water)

   Note: The following shelf lives must be adhered to:
   - Spray bottles of bleach, ETOH, IPA, DI water must be replaced monthly.

2. Materials

   2.1. Spray Bottles
   2.2. Wash Bottles
   2.3. Sterile Disposable Gloves
   2.4. Starch Iodide Indicator Paper
   2.5. Shatter Proof Waste Containers
   2.6. Large Plastic Bags
   2.7. Duct Tape
   2.8. Vermiculite
   2.9. Absorbent Toweling

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2.10. Autoclave Bags
2.11. Autoclave Bag Holder
2.12. Small wide mouth glass storage jars

3. Equipment

3.1. Drying Autoclave

C. PROCEDURE

The procedures for decontaminating work surfaces and supplies prior to and after working with forensic samples that are potentially contaminated with chemical and biological warfare agents are outlined below. At all times the operator is dressed in appropriate approved personal protection equipment (PPE) and use good laboratory practices.

1. The following procedure is used to prepare the work area, biological safety cabinet, chemical fume hood, glove box, and ancillary equipment for the next use.
   Note: These procedures will be completed following each sample being processed to ensure no cross contamination will occur.
   1.1. Place all contaminated consumable supplies into a large shatter proof waste container and submerge in bleach for 24 hours. Upon standing for 24 hours, check the bleach using starch iodide indicator paper to assess the presence of active chlorine. If the starch indicator paper does not turn purple, indicating no active chlorine is present, add more bleach and continue soaking for an additional 24 hours. If the starch indicator designates active chlorine is present, by turning purple, remove solids from the liquid and place into another waste container along with some vermiculite to collect the remaining liquids. Double bag containers and seal with a "J" seal with duct tape and remove from the engineering control device and dispose of according to local procedures.
   Note: If the sample is determined to be biological in nature and not chemical, solid waste can be placed in an autoclave bag and autoclaved at 121°C for 60 minutes before discarding.
   1.2. The following procedure will be used to decontaminate reusable supplies/ancillary equipment and remove them from engineering controls.
   Note: This procedure is only applicable to non-permeable items that can be completely surface deconned.
      1.2.1. Soak a clean absorbent towel with 5% sodium hypochlorite. Wipe down the entire surface of the item/area.
      1.2.2. Soak a clean absorbent towel with DI water. Wipe down the entire surface of the item/area.
      1.2.3. Dry the surface of the item/area with a clean absorbent towel.
      1.2.4. Soak a clean absorbent towel with ETOH or IPA. Wipe down the entire surface of the item/area and let air dry for one minute.
      1.2.5. Place all absorbent towels and gloves used during this process into the appropriate waste container or decon container containing bleach or other suitable decon and follow the process outlined in Section 1.1. If the workspace was used to process samples suspected to contain spores the bleach in the decontamination bucket must be pH stabilized to pH 6 - 7.

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1.3. Using a spray bottle with 5% sodium hypochlorite (bleach), spray a sufficient amount of bleach to wet the entire work surface. Wait one minute, and then wipe the surface dry with an absorbent towel.
1.4. Using a spray bottle of DI water, spray a sufficient amount of water to wet the entire work surface. Wipe the surface dry with an absorbent towel and allow the surface to air dry.
1.5. Using the ETOH or IPA, spray a sufficient amount to wet the entire work surface. Wipe the surface using an absorbent towel. Allow surface to air dry for one minute. **Note:** Place all absorbent towels used during this process into the appropriate waste container or decon container containing bleach or other suitable decon and follow the process outlined in Section 1.1. If the workspace was used to process samples suspected to contain spores, the bleach in the decontamination bucket must be pH stabilized to pH 6 - 7.
1.6. When necessary for quality assurance collect an aggregate quality control sample of the following areas using a gauze pad and extended reach forceps:
    1.6.1. Front lip- one wipe across the entire length of the front lip of the engineering control apparatus.
    1.6.2. Each corner- wipe each corner of the engineering control device for a total of 8 spots.
    1.6.3. Back- wipe across the entire length of the back panel of the engineering control device.
    1.6.4. Sink- if present, wipe the rim of the sink and the faucet.
    1.6.5. Rims of each pass through- if present, wipe the rims of each pass through port.
    1.6.6. Base- wipe the base of the engineering control device working from the front corner diagonally to the back corner and again from the other two corners making an x across the base with the center of it covering the area where work occurred.
    1.6.7. Place this QC sample into a clean labeled glass screw cap vial and analyze according to local methods.
1.7. Decontaminate gloves with the sodium hypochlorite spray prior to moving out of biological safety cabinets and glove boxes. Discard gloves into an appropriate waste receptacle or decon container containing bleach or other suitable decon.

D. SAFETY

Bleach is a strong oxidizing agent and should not come into contact with skin, eyes, or clothing material. Ethanol and IPA are highly flammable liquids and should be used with extreme caution and kept away from heat and open flames. Familiarization with the content contained in the MSDS and good laboratory practices will minimize the risk associated with this procedure.

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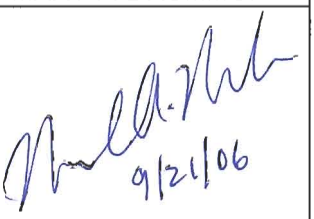
Revision History

Rev. No.	Description of Revision	Approval/Date
0	Original Document (*Author: Lisa S. Collins, Ph.D.*)	**ORIGINAL SIGNED BY; 6/26/01** MARY F. DRUMMOND
1	Removed the use of the DNA Erase Away throughout the entire procedure. Added IPA to ETOH or equivalent throughout the entire document, Took PCR workstation out of the purpose section and added chemical fume hoods, and gloveboxes. Removed the use of respirators when cleaning the work surfaces. Rewrote the procedures removing the DNA Away and included procedures for after working as well as prior to beginning work including deconning waste and QA swabs. Added the necessary materials to cover these updated procedures. (*Author: Nicole G McKew, Biologist and Jessica A. Cox, Chemist*)	 9/21/06 MELISSA A. MULLAN

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10.2 Appendix B: Example IOP for the Titration of Bleach and HTH

TITLE:	Bleach and HTH Titration
Prepared by: Douglas S. Nichols, Battelle Memorial Institute and Jessica A. Cox, EC/B FAC	Date Prepared: 08 August 2006
Reviewed By: Dennis K. Rohrbaugh 8-14-06 DENNIS K. ROHRBAUGH, Date Senior Chemist, EC/B FAC	Approved By: Stephen E. Lawhorne 15 Aug 2006 STEPHEN E. LAWHORNE, Date Chief, EC/B FAC
ISSUE DATE: AUG 16 2006	

PURPOSE-SCOPE:

This procedure will define the titration procedures for the verification of % active chlorine in the bleach and HTH used by the EC/B FAC for decontamination purposes.

BACKGROUND:

This is a general volumetric technique used to measure % active chlorine in sodium hypochlorite (bleach) and calcium hypochlorite (HTH). This titration depends on the chemistry of iodide (I^-), also referred to as Iodometry. The titration uses potassium iodide as the reactant, sodium thiosulfate as the titrant, and a starch solution as the indicator. The reaction of the sodium hypochlorite (bleach) or calcium hypochlorite (HTH) with excess potassium iodide in an acidic environment will convert iodide (I^-) to iodine (I_2). The iodine will produce a brown to amber color.

$$OCl^- + 2I^- + 2H^+ \rightarrow Cl^- + I_2 + H_2O$$

As the solution is titrated, via the addition of sodium thiosulfate, the thiosulfate reacts with the iodine, and converts it back to iodide turning the solution from brown to yellow to a pale yellow when near the endpoint and finally to a clear solution. Without the addition of the indicator the endpoint would be distinguished by the solution turning colorless.

$$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$$

This colorless endpoint provided by the conversion of I_2 to I^- is very difficult to obtain with precision thus a starch solution is added as an indicator. The starch forms a complex which results in a distinct blue color. The blue color can then be titrated to the colorless endpoint with more clarity.

$$I_2 + \text{Starch} \rightarrow [I_2\text{-Starch complex}]$$

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REFERENCES:

WI-098, Determination of Measurement Uncertainty
WI-099, Control of Certificates of Analysis and Certificates of Sterility
WI-200, Statistical Techniques
IOP-0940, General Guidelines for the Use of Laboratory Notebooks
DA PAM 385-61, Toxic Chemical Agent Safety Standards

REQUIRED MATERIALS:

1) 5% Sodium Hypochlorite (Houshold Bleach) or Calcium Hypochlorite (HTH)
2) 25 or 50 mL Buret
3) 0.1 N Sodium Thiosulfate ($Na_2S_2O_3$) **Note:** The normality of this solution must be either verified in-house or certified by an ISO Registered company. If a certification by an outside company is used, ensure that the Certificate of Analysis is obtained and controlled IAW WI-099.)
4) Deionized Water (DI H_2O)
5) Starch Indicator
6) Glacial Acetic Acid
7) Potassium Iodide (KI)
8) Ring stand with buret clamp
9) Balance
10) Pipettes
11) 100 mL Volumetric Flasks

MEASUREMENT UNCERTAINTY:

Sources of uncertainty shall be identified, determined and eliminated IAW WI-098.

PROCEDURE:

***Note: Make sure all devices required for this procedure are clean.**

1) For each lot of bleach tested, select one bottle and conduct testing in triplicate, as specified below on each bottle. For each lot of HTH, draw sample from different locations within the drum and conduct testing on the aggregate sample, in triplicate as specified below.
2) Weigh out approximately 1000 milligrams (mg) of bleach or HTH into a 100mL Erlenmeyer flask. Dilute to mark with deionized water (DI H_2O). This will be a 1:100 dilution. Record weight.
3) Transfer 25 mL of the 1:100 dilute bleach or HTH to an Erlenmeyer flask.
4) Add approximately two (2) grams of potassium iodide (KI) to the flask. Swirl to mix any undissolved KI. Record weight. Record company and lot # of KI.
5) Add 15 mL of glacial acetic acid to the flask. Swirl to mix. Solution will turn dark brown to amber in color. Record company and Lot # of the glacial acetic acid.

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6) Prepare a buret with 0.1 N sodium thiosulfate ($Na_2S_2O_3$). Slowly add $Na_2S_2O_3$ to the flask while swirling until the solution turns pale yellow to straw in color. This is an indication of being close to the endpoint. Record company and lot # of $Na_2S_2O_3$.
7) Add 10 drops of starch indicator. Starch will turn the solution blue. Continue slowly adding $Na_2S_2O_3$ until the color disappears. This is your endpoint. Record volume of $Na_2S_2O_3$ added.
8) Calculate the % active chlorine as specified below. Determine the average and standard deviation of the three samples taken from a given lot in accordance with WI-200.
9) The % active chlorine must be 3 or above (optimally 5%) for the bleach and 30 or above for the HTH in order to be used for the decontamination of chemical agents. If the average % active chlorine does not meet this specification, label the bleach or HTH accordingly and ensure that it is segregated from use in surety programs.
10) If the % active chlorine level is acceptable, label all containers for a given lot with the date of analysis, person conducting analysis, the average % active chlorine and an expiration date. Assign an expiration date of six (6) months from the date of analysis. **Note:** Bleach shall be stored in its original container and remain tightly sealed to avoid exposure to air as much as possible. If stored in an open container, such as a spray bottle, % active chlorine shall be reanalyzed or the contents discarded on a monthly basis.
11) All actions and appropriate readings will be recorded in the appropriate laboratory notebook in accordance with IOP-0940.

CALCULATIONS:

$$\text{Dilution Factor} = \frac{\text{mL of original sample}}{\text{mL of sample}} = \frac{100}{25} = 4$$

$$\%\ \text{Active Chlorine} = \frac{(\text{mL of Titrant} \times \text{Normality of titrant}) \times 35.45 \times \text{dilution factor}}{\text{weight of sample in milligrams}} \times 100\%$$

$$\%\ \text{Active Chlorine} = \frac{(\text{mL of Titrant} \times 0.1\text{N}) \times 35.45 \times 4}{\text{sample weight (mg)}} \times 100\%$$

$$\%\ \text{Active Chlorine} = \frac{(\text{mL of Titrant} \times 14.18)}{\text{sample weight (mg)}} \times 100\%$$

SAFETY:

HTH and bleach are strong oxidizing agents and should not come in contact with skin, eyes or clothing material. Potassium iodide and sodium thiosulfate solutions are irritants so avoid contact with skin. MSDSs are stored in the E5100 conference room (room 5).

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Revision History

Rev. No.	Description of Revision	Approval/Date
0	Original	MELISSA A. MULLAN 8/11/06

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10.3 Appendix C: Example SOP for AHRF BL-2/BL-3 Operations Lab Safety

The following is a generic standing operating procedure (SOP) for BL-2 and BL-3 laboratory operations. It is provided as an example of the type of SOP that will be needed to support operations in the AHRF. It is not intended to support the AHRF as written. Rather, it is intended to be modified by the local lab director and safety personnel to meet local requirements for safe operations.

STANDING OPERATING PROCEDURE

Building #

Room #

(check all that apply)
___Chemical Agent
__X__Biological/Toxin
____Radioactive Material/ Device Radiation
____Radiofrequency Radiation
____Lasers
____Industrial
____Pyrotechnics
____other(specify:_____)

AGENCY NAME AND/OR DIVISION

Title: BL-2/BL-3 Laboratory Safety Operations

SOP#: _ _ _–_ _ _ (assigned by Risk Reduction Office)

Submitted by:

_____
Team Leader/Division Chief

Environmental Quality Office: _____

Risk Reduction Office: _____

Approved by:_____
Director

APPROVAL DATE: _____

Prepared by: Name/Office Symbol

SOP TITLE: BL-2/BL-3 Laboratory Safety Operations

I have read and understand, or have had read to me and understand, the general and specific safety and environmental requirements, personnel and hazardous material limits, work description, and inspection requirements described in this SOP and Preparation of Standing Operating Procedures.

Signature	Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

1. SCOPE OF WORK: This SOP outlines the standard requirements and safeguards for operating a BSL2 and a BSL3 laboratory for the processing of unknown biological samples for the presence of various etiologic agents (bacteria, molds and yeasts, and biological toxins).

2. Responsibilities:

a**.** The established supervisor and operator responsibilities will comply with the instructions provided in Appendix A.

b. Additional Nonstandard Responsibilities
All personnel will comply with:

(1) Personnel who are immunocompromised or immunodeficient will not work in the laboratories. Workers who have a change in their medical status/condition are required to notify the laboratory supervisor and arrange for a medical re-evaluation conducted by an accredited physician.

(2) Viable organisms and biological toxins may not be removed from the laboratory unless double contained in unbreakable leak proof containers and must include written consent from the Director of the Biological Facility. The exterior surfaces of the primary and secondary container will be thoroughly decontaminated with 0.5% sodium hypochlorite or equivalent. The secondary container must be labeled and include the universal biohazard symbol.

3. Materials to be used:

BSL-2:Bacterias.molds yeasts/toxins

BSL-3:same as the BSL-2

Chemicals: 5% Sodium Hypochlorite or equivalent, EtOH, Deionized Water

The Director of the Biological Laboratory facility will maintain an inventory of all controlled or hazardous materials used in the laboratory.

4. Tools and Equipment: Glovebox, see manual for glovebox operation.

5. Hazards

For general bio-laboratory precautions, see appendix B. For biological hazard descriptions, see appendix C.

BSL-2 microorganisms:
Organisms associated with human disease. Routes of entry for these hazards are auto-inoculation, ingestion, and mucus membrane exposure. Persons who are immunocompromised or immunosuppressed may be at an increased risk of acquiring infections and are not allowed to perform this operation or work in this laboratory.

BSL-3 microorganisms:
BL-3 organisms are indigenous or exotic agents that may cause serious and potentially lethal disease as a result of exposure by the inhalation route. Persons who are immunocompromised or immunosuppressed may be at an increased risk of acquiring infections and are not allowed to perform this operation or work in this laboratory.

Biological Toxins:
All toxins must be considered to pose a hazard in aerosol form. Most toxins exert their effects only after potential exposure or ingestion, and a few toxins present a dermal hazard. In general, toxins of biological origin are not instringinsically volatile. Laboratory safety precautions appropriate for handling toxins closely parallel those for handling infectious organisms.

- Use of the autoclave and incinerators could create a burn hazard to personnel.

- Laboratory chemicals/reagents: Primary hazard is from spills/splashes of toxic or caustic chemicals. MSDSs for chemical hazards will be posted in the laboratory.

A. Preventive Procedures
   1. Safety goggles or shield to be worn whenever there is a splash hazard.
   2. Safety shower and eyewashes will be monitored periodically for proper use and always be available for emergencies.
   3. The laboratory will be equipped with working fire extinguishers that are checked on a monthly basis. All fires will be reported to the fire department as soon as possible.
   4. Eating, drinking, smoking, and application of cosmetics will not be allowed in the laboratory area. These items will not be carried or stored in lab areas.

6. Safety Requirements

All personnel working in the laboratory must be adequately trained to perform their job and comply with all safety policies and procedures. Individuals must know the risks associated with their assigned duties and take appropriate safety precautions when performing these duties. Laboratory personnel must understand the selection, use and limitations of personal protective equipment (PPE). When a procedure requires the use of PPE, individuals must use it properly. All laboratory staff members must be familiar with all of the emergency procedures including contact in formation prior to any accidental spills, exposures, fires, etc. All employees are responsible for reporting any unsafe acts to their supervisor and or safety officer.

BSL-2 Entry/Exit Requirements:

1. The BSL-2 laboratory doors will be kept closed and locked at all times.
2. At no time will minors (under the age of 18) be allowed in the BSL-2 facility.
3. Personnel who are (or suspected to be) immunodeficient or immunocompromised cannot enter the BSL-2 laboratory.
4. Visitors can only enter the laboratory if etiological agents are double contained and all work surfaces have been decontaminated with 70% ethanol or equivalent.
5. Operations will not be performed with etiologic agents while visitors are in the BSL-2 laboratory unless prior approval is provided by the Director of the BSL-2 facility and the Safety Advisor.
6. Work area entrances will be posted with the following:
   a. Hazard warning sign with universal biohazard symbol and biosafety level.
   b. Sign with work area supervisor and telephone number.
   c. BSL-2 entry requirements, including necessary protective clothing and equipment.
7. Access to BSL-2 laboratories is limited by the commander or institute director.
8. Only persons advised of potential hazards and meeting entry requirements may enter the laboratory.

BSL-3 Entry/Exit and general laboratory Requirements:

All requirements for the BSL2 laboratory are followed in addition to the following:

1. The BSL-3 must have a physical separation from access corridors.
2. The BSL-3 must be equipped with self closing, double door access.

3. The air in the laboratory must be exhausted air not re-circulated.
4. Access to these laboratories is limited to mission critical personnel.
5. Doors leading to these areas are secured with locks or equivalent means, to prevent unauthorized entry.
6. Laboratory personnel must shower in the designated shower area after removing laboratory personal protective clothing and before exiting the facility.

Housekeeping:
The work site shall be maintained in a clean and sanitary condition. All equipment, environmental enclosures and working surfaces shall be properly cleaned and disinfected with 70% ethanol (or equivalent) after contact with potentially infectious materials. 70% ethanol will be freshly prepared (within last 2 weeks) and sterile filtered or purchased gamma-irrradiated to prevent contamination.

Work surfaces shall be decontaminated with 70% ethanol (or equivalent) after completion of procedures; when surfaces are overtly contaminated; immediately after the spill of potentially infectious materials; and at the end of the work shift.

Work must be conducted over spill trays or plastic-backed absorbent material. Protective coverings such as plastic wrap, aluminum foil, or plastic backed absorbent paper may be used to cover equipment and environmental surfaces. These coverings shall be removed, disposed as biohazardous waste, and replaced when they become contaminated or at the end of the work shift.

Equipment which may become contaminated with potentially infectious materials shall be checked routinely and shall be decontaminated with 0.5% sodium hypochlorite (or equivalent), as necessary. Potentially contaminated equipment must always be decontaminated prior to servicing and/or removal from the laboratory. A record of the decontamination process should be maintained in an equipment logbook and should include the following information: reason for decontaminating, method of decontamination, approval of the director, date initials of operator performing decontamination, and disposition of equipment.

All bins, pails, cans, and similar receptacles intended for re-use which have a potential for becoming contaminated with potentially infectious material shall be inspected, cleaned, and disinfected with 70% ethanol (or equivalent) on a regularly scheduled basis. All containers will be cleaned and disinfected immediately, or as soon as possible, upon visible contamination.

Reusable items contaminated with potentially infectious materials shall be decontaminated with 70% ethanol (or equivalent) prior to washing and/or reprocessing.

Plastic labware is preferred over glassware whenever possible. Broken glassware will not be picked up directly with the hands. It will be cleaned up using mechanical means such as a brush and dustpan, tongs, or forceps. All of the aforementioned should be treated as a sharp.

Specimens of potentially infectious materials shall be double contained when stored or when transported out of the primary engineering controls (biosafety cabinet). The outer (secondary)

container will be leak proof and break proof and filled with sufficient absorbent material to contain the contents of the primary container.

After decanting a liquid culture containing viable microorganisms, the vial containing the culture must be wiped with 70% ethanol (or equivalent) to disinfect and remove contaminants from the lip of the vial.

Equipment/Articles Leaving the Laboratory:
Equipment/articles leaving the laboratory must be effectively decontaminated by chemical decontaminations or other verifiable method. Equipment/articles include primary sample containers, sample preparation equipment, and analytical instrumentation.

Alternative decontamination protocols will be coordinated with the Director of the laboratory and the Biosafety Advisor prior to removing items from the containment. DNA and other genetic elements which have been separated from viable etiologic agents can be removed from containment providing that (1) samples of DNA or other genetic material are screened for viability prior to release and are demonstrated to be nonviable and (2) prior to written approval is obtained from the Director of the laboratory and the Biosafety Advisor.

Protective Clothing and Equipment in the BSL-2 Laboratory:
Laboratory coat or disposable Tyvek™ laboratory coat: A clean laboratory coat will be worn by all personnel over their personal clothes and removed before exiting the BSL-2 facility, or a disposable laboratory coat will be worn and disposed of as hazardous waste upon finishing work in the BSL-2 lab.

Gloves: All personnel working in the BSL-2 laboratory with hazardous organisms will don nitrile or equivalent gloves. In some instances double gloving may be appropriate. If a spill occurs, hands will be protected after the contaminated outer gloves are removed. Gloves will be disposed of as biohazardous waste whenever they become contaminated, after performing work likely to result in glove contamination, upon completion of lab protocols involving etiologic agents, and whenever leaving the BSL-2 lab. At no times will gloves be worn outside the laboratory. Personnel will wash hands with an appropriate decon solution/soap after work with etiologic gents and/or toxins.

Gloves must be selected based on the hazards involved and the activity to be conducted. Gloves must be worn when working with biohazards, toxins, and other physically hazardous agents. Temperature resistant gloves must be worn when handling hot material or dry ice. Delicate work requiring a high degree of precision dictates the use of thin walled gloves. Additional protection from contact with toxic or corrosive chemicals may also be required.

Protective Clothing and Equipment in the BSL-3 Laboratory:
Laboratory coat or disposable Tyvek™ laboratory coat: A clean laboratory coat will be worn by all personnel and removed before exiting the facility. Laboratory personnel must remove all personal belongings including their personal clothing prior to entering the laboratory. Scrubs or other disposable clothing may be worn. All lab clothing will undergo decontamination prior to laundering. Disposable lab coats will be disposed of as hazardous waste.

Gloves: All personnel working in the laboratory with hazardous organisms will don nitrile or equivalent gloves. In some instances double gloving may be appropriate. If a spill occurs, hands will be protected after the contaminated outer gloves are removed. Gloves will be disposed of as biohazardous waste whenever they become contaminated, after performing work likely to result in glove contamination, upon completion of lab protocols involving etiologic agents, and whenever leaving the lab. At no times will gloves be worn outside the laboratory. Personnel will wash hands with an appropriate decon solution/soap after work with etiologic gents and/or toxins.

Gloves must be selected based on the hazards involved and the activity to be conducted. Gloves must be worn when working with biohazards, toxins, and other physically hazardous agents. Temperature resistant gloves must be worn when handling hot material or dry ice. Delicate work requiring a high degree of precision dictates the use of thin walled gloves. Additional protection from contact with toxic or corrosive chemicals may also be required.

When a procedure or a process cannot be conducted within a biological safety cabinet, or when a laboratory worker has not had the appropriate vaccinations, then appropriate combinations of personal protective equipment and physical containment devices are used.

Engineering Control Checklist:
Lab personnel will maintain a daily log of engineering control readings. Biosafety cabinet readings will be recorded on the daily log sheet. The Director of the lab will note log sheet trends and contact the biosafety officer whenever there is a substantial deviation of readings from normal readings.

1. All windows are closed and sealed.
2. Each laboratory room contains a sink for hand washing. The sink must be hands-free or automatically operated and is located near the room exit door.
3. The interior surfaces of walls, floors, and ceilings of areas where the BSL-3 agents are handled are constructed for easy cleaning and decontamination.
4. Bench tops are impervious to water and are heat resistant to moderate heat and the organic solvents, acids, alkalis and those chemicals used to decontaminate the work surfaces and equipment.
5. Biological safety cabinets are required and are located away from doors, from supply louvers, and from heavily-traveled laboratory areas.
6. A ducted air ventilation system is provided. This creates directional airflow which drawls air into the laboratory from “clean” areas and toward “contaminated” areas. The exhaust air is not re-circulated to any other area of the building. The outside exhaust air must be dispersed away from occupied areas and air intakes, or the exhaust must be HEPA filtered. Laboratory personnel must verify that the direction of the airflow (into the laboratory) is proper. It is recommended that a visual monitoring device that indicates and confirms directional inward airflow be provided at the laboratory entrance.
7. HEPA filtered exhaust air from Class II biological safety cabinet can be re-circulated into the laboratory if the cabinet is tested and certified at least annually. When exhaust air from Class II safety cabinets is to be discharged to the outside through the building

exhaust system, the cabinets must be connected in a manner that avoids any interference with the air balance of the cabinets or the building exhaust system. When Class III bio safety cabinets are used they should be directly connected to the exhaust system. If the Class III cabinets are connected to the supply system, it is done in a manner that prevents positive pressurization of the cabinets.

8. Vacuum lines are protected with liquid disinfectant traps and HEPA filters, or their equivalent. Filters must be replaced as needed. An alternative is to use portable vacuum pumps (also protected with traps and filters).
9. An eyewash station is readily available inside the laboratory.
10. Illumination is adequate for all activities, avoiding reflections and glare that could impede vision.
11. Continuous flow centrifuges or other equipment that may produce aerosols are contained in devices that exhaust air through HEPA filters before discharge into the laboratory. These HEPA systems are tested at least annually. Alternatively, the exhaust from such equipment may be vented to the outside if it is dispersed away from occupied areas and air intakes.
12. The laboratory facility design and operational procedures must be documented. The facility must be tested for verification that the design and operational parameters have been met prior to operation. Facilities should be re-verified , at least annually, against these procedures as modified by operational experience.
13. Additional environmental protection (eg. Personnel showers, HEPA filtration of exhaust air, containment of other piped service and the provision of effluent decontamination) should be considered if recommended by the agent summary statement, as determined by risk assessment, the site conditions, or other applicable federal, state, or local regulations.

Two Person Rule Requirements:
Two authorized personnel, each familiar with applicable safety and security requirements and who are capable of performing first aid in case of exposure to biological agent are required to work in the lab at all times. Both individuals must be capable of detecting incorrect or unauthorized procedures with respect to the task being performed. The samples that are received are unknown to the analyst and the two person rule is required.

Security of Stored Etiologic Agents:
Etiologic agents will be stored in locked freezers. The storage freezer will be posted with an inventory of its contents and labeled with the universal biohazard symbol. The Director of the facility will ensure that storage freezer keys are secured and used only by authorized personnel. The Director will maintain a written record of keys issued to authorized personnel.

Storage of infectious biological agents will be IAW Appendix D.

Additional Equipment Safeguards:

BSL-2/BSL-3
Blenders, Centrifuges, Ultrasonic Disrupters, and Grinders: The use of any of these devices can result in considerable aerosol production. Blending, cell disrupting and grinding equipment should be used in a biosafety cabinet when working with bio-hazardous materials. Safety

blenders, although expensive, are designed to prevent leakage from the bottom of the blender jar, provide a cooling jacket to avoid biological inactivation and to withstand sterilization by autoclaving. If blender rotors are not leak-proof, they should be tested with sterile saline or dye solution prior to use with biohazardous material. The use of glass blender jars is not recommended because of the breakage potential. If they must be used, glass jars should be covered with a polypropylene jar to prevent spraying of glass and contents in the event the blender jar breaks. A towel moistened with disinfectant should be placed over the top of the blender during use. Before opening the blender jar, allow the unit to rest for at least one minute to allow the aerosol to settle. Place the device in an autoclave bag before removing it from the biosafety cabinet. The device should be decontaminated promptly after use via the autoclave. Although centrifuges can be used outside a biosafety cabinet, centrifuges and centrifuge tubes should be checked for signs of leakage following operation. Centrifuge tubes should be opened in a biosafety cabinet when working with biohazardous materials.

Lyophilized culture materials in ampoules: opening ampoules containing liquid or lyophilized culture material should be performed in a biosafety cabinet to control the aerosol produced. Gloves must be worn. To open, nick the neck of the ampoule with a file, wrap it in disinfectant soaked towel, hold the ampoule upright and snap it open at the nick. Reconstitute the contents of the ampoule by slowly adding liquid to avoid aerosolizatioin of the dried material. Mix the contents without bubbling and withdraw it into a fresh container. The towel and ampoule will be autoclaved and disposed as biohazardous waste.

An autoclave must be present in the laboratory to decontaminate any contaminated materials before disposing of them. All tests involving the manipulation of or handling of infectious materials shall be conducted in a biological safety cabinet.

Additional Safeguards/Requirements
All items/materials potentially contaminated with BSL-3 microorganisms will be decontaminated with an appropriate decon solution such as 0.5% sodium hypochlorite (or equivalent), followed by autoclaving.

Operations will be designed so as not to generate aerosols or release etiologic agents outside of biosafety cabinets or other approved engineering controls.

To avoid autoinoculation by syringes, needles will not be manually bent, sheared, recapped, replaced, or otherwise removed from the syringe by hand following use. All “sharps” will be decontaminated and placed in a puncture resistant container. The sharps container will be autoclaved and disposed as biohazardous waste.

Eyewashes and safety showers will be readily accessible to the work area. Fire extinguishers may be used on incipient stage fires, by trained personnel only. Professional fire fighters will fight other fires. All fires (including extinguished fired) will be reported to the Fire Department by dialing 911 and to the safety office.

Spills and accidents with microbiological or chemical agents will be reported immediately to the supervisor and the safety personnel in charge of the BSL-2 facility.

7. Procedures

A. Hazardous Operation Pre-operational Checklist will be read, completed and signed prior to the initiation of each operation.
B. All chemical solutions (acids, bases, and buffers") will be prepared and used in a certified and alarmed chemical fume hood.

APPENDIX A
BIOLOGICAL RESPONSIBILITIES

A-1.

(1) Assist supervisors in developing appropriate laboratory practices and engineering controls for the operation.

(2) Provide technical guidance as required or requested related to biohazard classification, engineering, administrative and work practice controls, and the selection of personal protective clothing and equipment (PPC&E). Classification of organisms will be IAW National Institutes of Health and Centers for Disease Control guidelines.

(3) Provide, as a minimum, quarterly inspections of the work area.

(4) Investigate all accidents/illnesses and recommend corrective actions to reduce the potential for recurrence.

(5) Develop, recommend, and/or conduct appropriate training and information programs for safe handling of biological specimens.

(6) Act as the single POC for the Centers for Disease Control and Prevention and the Special Immunization Program

A-2. Supervisors will:

(1) Ensure SOPs are developed and staffed for the use of biohazardous materials to include personal protective clothing and equipment required, decontamination and waste disposal procedures for the specific materials to be used, and that employees have read and signed the SOPs prior to beginning operations.
(2) Ensure personnel are medically cleared prior to being assigned to work with or handle microorganisms.

(3) Train personnel and provide employees with the proper personal protective clothing and laboratory equipment and enforce the proper use and wearing thereof.

(4) Post areas that are restricted for unauthorized personnel and control entry to those areas.

(5) Report all accidents.

(6) Ensure all investigators/operators are knowledgeable and experienced in the operation of all equipment and devices to be used and aware of the hazards involved.

(7) Enforce SOPs and ensure this regulation is followed.

A-3. Operators will:

(1) Conduct operations in accordance with approved SOPs.

(2) Report to their supervisor any hazardous conditions, any violations of operating procedures, or any circumstances that are not typical or in accordance with an approved SOP.

(3) Maintain a safe, clean, and healthful work area.

(4) Utilize protective equipment and clothing issued to them and required by the SOP for a specific operation.

(5) Make themselves available in any emergency situation where their assistance is needed to maintain safe operational conditions.

(6) Inform supervisors of any health conditions that may affect their ability to perform microbiological work.

APPENDIX B
GENERAL BIO-LABORATORY PRECAUTIONS

B-1. Precautions.

a. No unauthorized person will be allowed in the laboratory during operations.

b. No storage or use of food, beverage, smoking materials, chewing gum or cosmetics are allowed within a laboratory room involved with microbiological/toxin use or storage.

c. Personal hygiene is very important.

(1) Hands will be washed immediately after completion of procedures.

(2) Disposable cleaning tissues will be used rather than a personal handkerchief.

(3) Persons with a laceration or skin lesion should not work in the facility unless the injury is fully protected.

(4) Hands will be kept away from mouth, nose, eyes, face, and hair.

d. No mouth pipetting. Use only mechanical pipettes. Blowing out the last drop from a pipette may create an aerosol.

e. Housekeeping. It is important that housekeeping tasks be assigned to personnel who are knowledgeable of the research environment. This approach assures that the location of hazardous contaminated equipment, etc., will be known. This equipment will be handled only by those most knowledgeable of how it should be handled. Personnel should be assigned their immediate work area for individual clean-up while assigning the common area to everyone. The laboratory supervisor must determine the frequency with which tasks need to be accomplished. He/she should provide schedules and conduct inspections to assure compliance.

f. Federal law requires an SOP for all work with viable microorganisms/toxins within the scope of biodefense. An SOP which identifies known and potential hazards and which specifies practices and procedures to minimize or eliminate risks must be prepared. Personnel must be advised on special hazards and are required to read and follow the standard practices and procedures.

g. All personnel using autoclaves shall be fully familiar with autoclave operation, care, cleaning and maintenance prior to their use. All personnel must be trained in the operation of laboratory equipment.

h. All procedures must be conducted carefully to minimize the production of aerosols.

i. All work with BSL-2 and higher microorganisms must be performed in a certified biological safety cabinet. All work with unsealed toxins will be done in a HEPA filtered fume hood, biosafety cabinet or glove box.

j. Upon completion of an operation:

(1) Gloves will be removed with motions that turn the gloves inside out. Any contact between the skin and the outer, contaminated glove surface will be avoided.

(2) Hands will be washed with soap and water.

(3) Gloves will be disposed of in a special medical waste container.

APPENDIX C
BIOLOGICAL HAZARD DESCRIPTIONS

C-1. Biosafety Levels.

NOTE: The term "agent" or "agents" in these paragraphs refers to microorganisms and toxins, not to chemical surety materiel.

The recommended biosafety level represents those conditions under which the microorganism or toxin can be safely handled. The laboratory supervisor is specifically and primarily responsible for assessing risks and for appropriately applying the recommended biosafety levels. If an organism does not have a recommended biosafety level (per CDC and NIH Guidelines) the laboratory supervisor will request an assessment by the governing authority.

a. Biosafety Level 1 practices, safety equipment, and facilities are appropriate for facilities in which work is done with defined and characterized strains of viable microorganisms not known to consistently cause disease in healthy adult humans. Bacillus subtilis, Naegleria gruberi, and canine hepatitis virus are representative of those microorganisms meeting these criteria.

(1) Many agents not ordinarily associated with disease processes in humans are, however, opportunistic pathogens and may cause infection in the young, the aged, and immunodeficient or immunosuppressed individuals. Vaccine strains which have undergone multiple in vivo passages should not be considered avirulent simply because they are vaccine strains.

(2) Biosafety Level 1 represents a basic level of containment that relies on standard microbiological practices with no special primary or secondary barriers recommended, other than a sink for hand washing.

b. Biosafety Level 2 practices, equipment, and facilities are applicable to clinical, diagnostic, teaching and other facilities in which work is done with the broad spectrum of indigenous moderate-risk agents present in the community and associated with human disease of varying severity. With good microbiological techniques, these agents can be used safely in activities conducted on the open bench, provided the potential for producing splashes or aerosols is low. Hepatitis B virus, the salmonellae, and Toxoplasma spp. are representative of microorganisms assigned to this containment level.

(1) Biosafety Level 2 is appropriate when work is done with any human-derived blood, body fluids, or tissues where the presence of an infectious agent may be unknown. (Laboratory personnel working with human-derived materials should refer to the OSHA Bloodborne Pathogen Standard, 29 CFR 1910.1030, for specific, required precautions).

(2) Primary hazards to personnel working with these agents relate to accidental percutaneous or mucous membrane exposures, or ingestion of infectious materials. Extreme precaution with contaminated needles or sharp instruments must be emphasized. Even though organisms routinely manipulated at BSL2 are not known to be transmissible by the aerosol route, procedures with aerosol or high splash potential that may increase the risk of such personnel exposure must be conducted in primary containment equipment, or devices such as a biosafety cabinet (BSC) or safety centrifuge cups. Other primary barriers should be used as appropriate, such as splash shields, face protection, gowns, and gloves.

(3) Secondary barriers such as hand washing and waste decontamination facilities must be available to reduce potential environmental contamination.

c. Biosafety Level 3 practices, safety equipment, and facilities are applicable to clinical, diagnostic, teaching, research, or production facilities in which work is done with indigenous or exotic agents with a potential for respiratory transmission, and which may cause serious and potentially lethal infection. Mycobacterium tuberculosis, St. Louis encephalitis virus, and Coxiella burnetii are representative of microorganisms assigned to this level.

(1) Primary hazards to personnel working with these agents relate to autoinoculation, ingestion, and exposure to infectious aerosols.

(2) At Biosafety Level 3, more emphasis is placed on primary and secondary barriers to protect personnel in contiguous areas, the community, and the environment from exposure to potentially infectious aerosols. For example, all laboratory manipulations should be performed in a BSC or other enclosed equipment, such as a gas-tight aerosol generation chamber. Secondary barriers for this level include controlled access to the laboratory and a specialized ventilation system that minimizes the release of infectious aerosols from the laboratory.

APPENDIX D
BIOLOGICAL STORAGE

D-1 CDC Select Agents or Toxins

a. All Select Agents or Toxins must be stored in CDC Select Agent registered storage areas.

b. Only CDC/DOJ approved personnel are allowed access to select agent material

c. Documentation should be made concerning any addition or removal of select agent material.

D-2 Non – CDC Select Agents and Toxins

a. Infectious materials shall be stored only in designated and labeled refrigerators, incubators, or freezers.

b. All infectious or toxic material stored in locked refrigerators or freezers should be properly labeled and stored in containers capable of withstanding the thermal shock of freezing and thawing. The refrigerators or freezers should be labeled as containing infectious material.

c. Log books shall be maintained for all freezers containing pathogenic specimens or organisms.

d. When work is completed, all infectious cultures or toxins will be removed from the work bench and biological safety cabinets and stored in a designated refrigerator or freezer. If they are to be discarded, they will be placed in disinfectant, autoclaved, or confined in closed labeled container (e.g., "contaminated, to be autoclaved") in a designated refrigerator.

APPENDIX E
BIOLOGICAL EMERGENCY PROCEDURES

Due to the varied nature of possible emergencies that can arise, it is not possible to recommend a single plan of action that would be applicable to all situations. An SOP for the specific operation will outline emergency procedures tailored to that operation. The following is a sample of suggested emergency response procedures:

1. GENERAL: In the event of an accident or incident, notification will be made to the following:

(1) Immediately dial 911. Provide as much information as possible to the operator.
(a) Where is the accident or incident (building and room number)?
(b) What is involved?
(c) Was anyone possibly exposed?
(d) Was anyone injured?
(e) Was the building evacuated?

(2) Contact the first line supervisor as soon as possible

An accident or incident may be defined as, but is not limited to, any of the following:

(1) An actual or suspected, spill or release of Biological Defense Program, Research, Development, Test, and Engineering (BDP RDTE) material outside of engineering controls.
(2) Injury or illness, signs or symptoms related to potential or known exposure to chemical, biological, or radiological materials
(3) Release of or exposure to a hazardous chemical
(4) Severe injury (err on the side of caution when deciding what is severe)
(5) Fire, regardless of magnitude

The person in charge will secure the scene except for the necessary movement of safety and security personnel.

The need to dial 911 is situational outside of the laboratory, CTF, and chambers, and in such situations each person should use his/her best judgment when an accident or incident occurs.

If there is any doubt as to whether you should or should not dial 911, dial it and let the emergency responders determine the proper level of response.

2. In the event of personnel exposure to biological agents via inhalation, ingestion or subcutaneous exposure, dial 911. The operator will be told the nature of trauma, what type of first aid was administered and the name of the organism the person was handling. Transport of injured personnel to the medical treatment facility will occur.

a. Any real or suspected contamination of the eyes should be immediately rinsed using an eyewash station for at least 15 minutes.

b. For skin exposure, the area must be washed with a germicidal soap and

then rinsed with water.

c. Any suspected contaminated clothing will be removed, bagged and autoclaved.

3. In the event of a spill of biological materials, evaluate the potential for the formation of aerosols.

a. If an aerosolization may have occurred, or the operator is not able to contain the spill, evacuate the laboratory and dial 911.

b. If the spill is within engineering controls or does not present an aerosol hazard, the area will be covered with absorbent towels and decontaminated with a suitable disinfectant. Following sufficient contact time, the absorbent material will be collected and containerized for disposal.

4. Spills of hazardous chemical outside of engineering controls must be reported to the fire department.

5. In the event of a fire, dial 911 to activate the emergency response plan. Fire extinguishers may be used on incipient stage fires only. Personnel must be trained IAW 29 CFR Part 1910 to use the fire extinguisher on an incipient stage fire.

10.4 Appendix D: Example Laboratory Chemical Hygiene Plan

The following is a generic laboratory chemical hygiene plan. It is provided as an example of the type of plan that will be needed to support operations in the AHRF. It is not intended to support the AHRF as written. Rather, it is intended to be modified by the local lab director and safety personnel to meet local requirements for safe operations.

DEPARTMENT OF THE ARMY
U.S. ARMY EDGEWOOD CHEMICAL BIOLOGICAL CENTER
Aberdeen Proving Ground, Maryland 21010-5424

CHEMICAL HYGIENE PLAN

March, 2004

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1. Purpose. This policy establishes the Edgewood Chemical Biological Center (ECBC) Chemical Hygiene Plan (CHP). The CHP establishes responsibilities, policies and procedures for handling hazardous chemicals in the laboratory. Military unique chemical agent or acutely toxic material, toxins and radionuclides are included in the scope of this CHP. Regulatory requirements for safe handling of these agents are found in the referenced documents in appendix A.

2. Applicability. The CHP applies to all U.S. Army ECBC elements located in the Edgewood Area of Aberdeen Proving Ground (APG) who engage in laboratory operations with hazardous chemicals and toxins as defined in appendix B.

3. References. A list of references is found at appendix A.

4. Explanation of Terms. An explanation of terms used in the CHP is found at appendix B.

5. Responsibilities.

a. The Chemical Hygiene Officer (CHO) for ECBC, Mr. Timothy W. Williams, CIH, CSP, Master Industrial Hygienist, Risk Reduction Office, shall:

(1) Provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.

(2) Review plans and specifications for laboratory construction or renovation to ensure appropriate design criteria are incorporated.

(3) Ensure hood certification is conducted and approved procedures are used to evaluate hood performance.

b. Risk Reduction Office, Risk Management Division shall:

(1) Conduct periodic inspections of all laboratories where hazardous chemicals and toxins are used. Frequency shall be determined based on hazard severity.

(2) Investigate all reported accidents which result in a potential exposure to hazardous chemicals and toxins.

(3) Review SOPs for all laboratory operations using hazardous chemicals and toxins.

(4) Conduct pre-operational surveys of all new laboratory operations using hazardous chemicals and toxins.

(5) Coordinate Risk Reduction participation in a hazard analysis of each new operation.

(6) Review plans and specifications for all laboratory construction or renovation to ensure appropriate design criteria are incorporated.

c. Environmental Quality Office, Chemical Biological Services Division shall:

(1) Provide guidance on hazardous waste handling and disposal.

(2) Provide assistance visits to all laboratories where hazardous waste is generated or stored.

(3) Conduct pre-operational surveys of all new laboratory operations using hazardous chemicals and toxins.

d. KUSAHC, Preventive Medicine Services shall provide preventative medicine services IAW the established Inter-Service Support Agreement, APGR 385-4 and AR 40-5.

e. Laboratory supervisors shall:

(1) Ensure laboratory personnel have read, understood, and follow the CHP.

(2) Ensure that an SOP is prepared and approved for laboratory operations using hazardous chemicals and toxins.

(3) Ensure that laboratory personnel receive job-related medical surveillance from KUSAHC.

(4) Ensure that personnel working with hazardous chemicals and toxins have read, signed, and been trained to conduct operations under approved SOPs.

(5) Ensure that personnel have received hazard communication training.

(6) Ensure that personnel are provided personal protective clothing and equipment necessary for the operation; and are provided adequate training in their use.

(7) Conduct inspections of laboratory operations using hazardous chemicals and toxins as required to ensure compliance with the SOP, CHP, and applicable regulations.

(8) Ensure that hazardous waste handlers receive initial hazardous waste training and refresher classes.

(9) Ensure compliance with hazardous chemical and toxin storage and distribution requirements.

(10) Conduct hazardous chemical training in conjunction with the hazard communication program (HAZCOM).

(11) Ensure that semi-annual certification and maintenance is provided for laboratory ventilation systems (chemical fume hoods, gloveboxes, biological safety cabinets) and autoclaves.

f. Laboratory personnel shall:

(1) Plan and conduct laboratory operations using hazardous chemicals and toxins IAW the SOP, CHP, and applicable regulations.

(2) Use the protective clothing and equipment necessary to conduct the operation in a safe manner.

(3) Report hazardous conditions, exposures or abnormal circumstances associated with an operation to their supervisor.

(4) Be registered in the Occupational Health Program and report for any job-related medical surveillance required by KUSAHC.

(5) Manage laboratory waste IAW applicable environmental regulations.

(6) Ensure that medical support for chemical agent operations is available prior to beginning the operation.

(7) Be familiar with the contents and location of MSDSs for chemicals and toxins used in the laboratory.

6. Policy.

a. The CHP establishes the minimum Army and federal requirements for the safe use of hazardous chemicals and toxins in the laboratory. Chemical and toxin exposure shall be minimized through the use of engineering and administrative controls, work practices and protective clothing and equipment.

b. Laboratory personnel shall not be exposed to airborne concentrations which exceed the more stringent of the permissible exposure limit (PEL), airborne exposure limit – worker population limit (AEL – WPL) or threshold limit value (TLV) for a specific compound or mixture. Information on exposure limits is available from the Risk Reduction Office.

c. Acutely toxic compounds, carcinogens, toxins and reproductive toxins shall be handled using the special procedures found in paragraph 22 of this policy.

7. Program Administration.

a. Standing operating procedures shall be prepared for hazardous laboratory operations IAW the latest edition of ERDEC-SP-058, Preparation of Standing Operating Procedures Guidebook. The SOP shall be forwarded to the ECBC Risk Reduction Office for staffing. The ECBC

Chemical Biological Services Division, and operating personnel shall complete a hazard analysis of each operation.

b. A pre-operational survey shall be conducted by the Chemical Biological Services Division to identify health, safety, environmental, and chemical agent (where applicable) issues before any new operation may begin. The SOP shall not be approved until the pre-operational survey is completed.

8. Procurement.

a. Purchase requests for chemicals and toxins should be ordered using DA Form 3953 (Purchase Request and Commitment). Personnel shall order the smallest quantity necessary to complete the work. The Material Safety Data Sheet (MSDS) shall be listed on the bill of lading as an item to be delivered with the chemical and toxin materials.

b. Laboratory personnel should review health and safety data on chemicals and toxins before receipt to determine special requirements for handling, storage and disposal. The MSDS is available from the specific manufacturer. Additional assistance is available through the ECBC Technical Library, and the Risk Reduction Office.

c. Personnel shall inspect containers upon receipt to ensure they are intact and not leaking. All containers shall be labeled IAW 29 CFR 1910.1200. Damaged or unlabeled containers shall not be accepted.

9. Chemical Storage.

a. Central Storerooms.

(1) New facilities shall be provided with central storerooms designed and constructed IAW NFPA 30. Hoods, gas cabinets or ventilated storage rooms should be provided when acutely toxic gases are stored in the laboratory.

(2) Requirements for central storage at existing facilities shall be evaluated by the Risk Reduction Office and the CHO on a case-by-case basis.

b. General. Chemical storage inside the laboratory shall be limited to those chemicals necessary to complete mission requirements. Central storerooms shall be used when they are available. Chemicals should not be stored on the bench. Open shelves should be designed with a restraining device or lip to prevent containers from creeping or tipping over.

(1) Chemicals will be stored IAW an approved compatibility system such as the Hazardous Material Information system (HMIS) or using the categories identified in appendix C. Chemicals stored in trays, designators or secondary containment large enough to contain the spill from the largest container, may be stored with chemicals from another group when they are located on the bottom of the cabinet. The Risk Reduction Office and the CHO shall approve exceptions to the categories in appendix C.

(2) Chemicals within a given storage group may be incompatible with other chemicals in that group. Laboratory personnel shall determine intra-category incompatibility and minimize incompatible storage when possible. Spill trays shall be used to reduce commingling in the event of spills or leaks. They should be used in shelves, cabinets, and in laboratory hoods dedicated for storage (e.g. hazardous waste). If spill trays are used in hoods, their placement must not interfere with the laminar airflow through the laboratory hood. The CHO should be contacted prior to new spill trays being placed in the hood to ensure that proper airflow will be maintained.

(3) Chemicals shall be inspected by laboratory personnel at least semiannually to determine their condition. Corroded or leaking containers shall be over packed and turned in along with outdated or excess chemicals IAW APGR 200-60.

(4) Chemical storage cabinets will be labeled as to the content such as flammables, corrosives, acids, etc.

c. Inventories.

(1) Inventories shall be available for each individual room where chemicals are stored or handled. The inventory shall be maintained by the room custodian and list the chemical name, quantity, container type, storage code, date received and expiration date (if applicable) IAW 29 CFR 1910.1200. Inventories shall be available to the Risk Reduction Office, Environmental Quality Office of ECBC.

(2) Copies of the inventories for a single laboratory building shall be maintained in a central location accessible to fire fighters or other response personnel in the event of an emergency.

d. Flammable and Combustible Liquids.

(1) The quantity of flammable and combustible liquids stored in a laboratory room shall not exceed 60 gallons or one month's supply, whichever is less. The quantity of liquids stored in an approved inside storage room shall be IAW NFPA 30.

(2) Flammable and combustible liquids shall be stored in glass, metal or plastic containers which meet the requirements of NFPA 30. Class I liquids shall be stored in approved safety cans when the container quantity exceeds 2 gallons. Combustible liquids shall be stored in approved safety cans when the container quantity exceeds 5 gallons.

(3) Flammable and combustible liquids shall be stored in approved cabinets designed IAW NFPA 30. Cabinets should not be located adjacent to an exit or in a stairwell. Cabinets shall not be vented without approval from the installation Fire Department.

(4) The transfer of Class I liquids to smaller containers from bulk containers not exceeding 5 gallons shall be conducted in a chemical hood or in an approved inside storage room. The

transfer of Class I liquids from bulk containers exceeding 5 gallons shall be conducted in an approved inside storage room or outdoors.

(5) Class I liquids shall not be transferred between metal containers unless the containers are properly bonded and grouped to discharge static electricity.

(6) Refrigerators and freezers used to store flammable liquids shall be explosion proof or "laboratory safe" IAW NFPA 45.

e. Water-Reactive Chemicals.

(1) Water-reactive chemicals shall be segregated from other chemical storage. These chemicals should be stored in approved cabinets designed IAW NFPA 30. If approved cabinets are not available, containers should be over packed in a metal can during storage. A list of some water reactive chemicals is found in appendix D.

(2) Water-reactive chemicals should not be stored with flammable or combustible liquids unless specifically recommended by prudent chemical storage guidelines. Cabinets used for storage of water-reactive chemicals shall be posted "CAUTION -WATER REACTIVE CHEMICAL." Such guidelines should be forwarded to the CHO.

f. Shock-Sensitive Chemicals.

(1) Unless the manufacturer has added an inhibitor, unopened containers of shock-sensitive chemicals should be turned in after 12 months of storage. Once opened, shock sensitive chemicals should be turned in after 6 months of storage.

(2) Shock-sensitive chemicals shall be prominently noted on the inventory. A list of some shock sensitive chemicals is found at appendix E.

g. Toxic Chemicals.

(1) Toxic chemicals should be segregated from other chemicals and stored in a closed cabinet. The cabinet shall be posted with AMSSB Form 1047 (HAZARDOUS MATERIAL). Flammable toxic chemicals shall be stored IAW paragraph 9d.

(2) Toxic chemicals should be stored in a well-ventilated area. The storage of unopened containers presents no unusual hazards. Once opened, containers should be sealed with parafilm or tape. Opened 55-gallon drums should have the lids, bungs, valves, etc. closed immediately after any dispensing.

h. Compressed Gases.

(1) General Requirements.

(b) Gas cylinders shall be secured by the use of clamps, chains or straps while in storage or use.

(c) When gas cylinders are not in use, hand valves shall be tightly closed and the valve projector cap shall be in place.

(d) Compressed gas from cylinders shall be reduced through the use of a regulator specifically designed for that purpose. Compressed liquefied gases, which use other industrial standard fittings, may be used after notifying the CHO.

(e) Reduction valves, gauges and fittings used for oxygen shall not be used for other gases. Likewise, valves, gauges and fittings used for other gases shall not be used for oxygen.

(2) Storage Requirements.

(a) Gas cylinders stored outdoors shall be located in a sheltered area protected from the elements. Gas cylinders shall not be stored near sources of ignition, heat or open flames.

(b) Gas cylinders shall not be stored in the laboratory room. Requirements for cylinder use shall be kept to a minimum. Manifold systems should be used when feasible.

(c) Gas cylinder storage areas shall be posted with the names of the gases in storage. Areas where hydrogen or other flammable gases are stored shall be posted "DANGER - FLAMMABLE GAS, NO SMOKING OR OPEN FLAMES WITHIN 50 FEET."

(d) Gas cylinders shall be segregated by their classification (i.e., flammable, toxic or oxidizer) IAW AR 700-68. Oxidizers shall be separated from flammable gases by at least 50 feet. The Risk Reduction Office must approve exceptions to this rule.

(e) Full and empty gas cylinders shall be stored in separate locations of the storage area. Empty gas cylinders shall be appropriately marked.

(f) Empty gas cylinders shall be returned to the manufacturer for refilling. Non-refillable cylinders shall be disposed of IAW APGR 200-60.

(3) Acutely Toxic Gases.

(a) Acutely toxic gases used in the laboratory shall be stored in a chemical hood or gas cabinet. Administrative controls such as reducing gas mixture concentrations and cylinder size shall be used to minimize risk. Flow limiting orifices shall be required on a case-by-case basis.

(b) Outdoor storage facilities should be located at least 50 feet from buildings. A gas cabinet should be provided to handle leaking cylinders.

i. Distribution.

(1) Toxic, flammable or corrosive chemicals should be placed in a carrying bucket or other unbreakable container when moved between rooms or through the laboratory corridors.

(2) Wheeled carts should be used to move larger quantities of chemicals, which cannot be hand-carried. Wheels shall be designed to travel over uneven surfaces without tipping or stopping suddenly. Carts with open shelves should be designed with a restraining device or lip to prevent containers from creeping or tipping over. Surfaces must be impervious to liquids.

(3) Freight elevators should be used to move chemicals between floors when available. Passenger elevators shall not be used when personnel are on board; however, these elevators may be placed out of service temporarily to move chemicals, or compressed gas cylinders.

(4) Compressed gas cylinders shall be moved using a suitable hand truck. Gas cylinders shall be strapped in place with the valve protector cap installed. Acutely toxic gases should be moved only when medical support is available and verified. Approved escape respirators shall be readily available in the event of an emergency.

10. Engineering Controls.

a. General Practice. Engineering controls including hoods, glove boxes, inhalation chambers, gas cabinets, local exhaust ventilation and substitution of less toxic chemicals should be used to minimize exposure to all hazardous chemicals in the laboratory.

b. Laboratory operations, which involve chemicals having a PEL or TLV of 100 ppm or less (gas or vapor) or 0.1 mg/m3 or less (aerosol) shall be planned and conducted using appropriate engineering controls. High-risk operations shall be conducted inside primary containment including chemical hoods, glove boxes or inhalation chambers. Low risk operations where the potential for generation of gas, vapor or aerosol contamination is remote may be conducted on the open bench.

c. Toxin Controls. For specific engineering controls utilized in laboratory toxin operations, follow the recommendations in chapter 8 of the DA PAM 385 – 69.

d. Design/Performance Criteria.

(1) Chemical Hoods.

(a) Hoods shall have an average face velocity of 100 linear feet per minute (lfpm) plus or minus 20 lfpm with the sash in the fully open position. Existing hoods designed and operating at 120 to 180 lfpm may be used as long as adequate performance is documented.

(b) Hood performance shall be evaluated semiannually and after any repair, maintenance, or modification to the ventilation system. Repairs, maintenance, or modifications to the ventilation system include, but are not limited to: belt changes; filter changes; adjustment to dampers; adjustment to alarm levels; changes to other hoods in a facility which thus may

affect the overall air balance; changes to the availability of makeup air in the facility. Ganged systems shall be evaluated together to determine the overall system performance. Hoods shall be evaluated IAW the Risk Reduction Office Internal Operating Procedure entitled, " Certification of laboratory Hoods and Glove Boxes."

(c) Hoods used for chemical agents, toxic compounds, carcinogens or reproductive toxins shall be equipped with audible and visual alarms. Each hood or set of ganged hoods should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use; however, general chemistry hoods may use swinging-arm anemometers.

(d) Prior to each day's operation, the laboratory operator shall use a swinging vane anemometer to check hood face velocity. If the average of at least three centerline readings is less than 80 fpm (120 fpm for "existing hoods"), operations shall not begin. Personnel shall notify the Risk Reduction Office immediately and prepare a work order to have the system repaired. The hood must be labeled to indicate that it is not operable. Once the work has been completed, the Risk Reduction Office shall be contacted to arrange for hood certification.

(e) Prior to conducting operations with perchloric acid, contact the Risk Reduction Office to confirm if appropriate engineering controls are available. The hood to be used must be designed to provide adequate airflow, wash down provisions, and is not used for any other purpose that may release organic materials into the hood. Organic materials and perchloric acid may crystallize on the interior surfaces of the ductwork and pose an explosive hazard.

(2) Glove Boxes.

(a) Glove boxes shall be maintained at a negative pressure of at least 0.25 inches water gauge, except during temporary opening of the ports (e.g., glove clamps). A manometer or differential pressure gauge shall be installed to monitor differential pressure.

(b) Glove boxes shall have an inward velocity of at least 90 fpm through all open ports or doors. Total makeup air volume shall be adequate to prevent explosive concentrations of gas, vapor or dust inside the enclosure.

(c) Glove box performance shall be evaluated semiannually, and after any repair or modification to the ventilation system. Contact the Risk Reduction Office to coordinate the evaluation.

(d) Employees working within an isolated system, such as a glove box shall wash their hands and arms upon completion of the assigned task, and before engaging in other activities not associated with the isolated system.

(3) Inhalation Chambers. The design and performance criteria for inhalation shall be the same as that for glove boxes.

(4) Gas Cabinets.

(a) Gas cabinets shall be ventilated at a minimum rate of 80 cubic feet per minute (cfm) per square foot of cabinet space (cross-sectional area) or 125 cfm per cylinder. An inward velocity of at least 200 fpm shall be maintained through the access door.

(b) A manometer or differential pressure gauge shall be installed to monitor differential pressure. Contact the Risk Reduction Office to coordinate evaluation.

(c) Cabinet performance shall be evaluated annually and after any repair or modification to the ventilation system.

(5) Local Exhaust Ventilation. Design/performance criteria for local exhaust ventilation should be IAW the American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation Manual (latest edition).

(6) Air Balance.

(a) Laboratories shall be maintained under negative pressure with respect to corridors and administrative areas. This requirement shall be monitored semiannually during hood performance evaluations. Exhaust air from laboratories shall not be recirculated. If the laboratory room comes under positive air pressure, personnel will contact the Risk Reduction Office for an evaluation.

(b) Adequate, conditioned makeup air shall be provided to ensure safe operation of the ventilation system.

e. Preventive Maintenance. Laboratory ventilation systems should be provided routine maintenance semiannually. Maintenance should be done IAW CRDECR 700-1.

f. Filtration and Vacuum Systems.

(1) Effluent from test equipment or apparatus should be filtered or scrubbed before discharge into primary containment if there is a potential for an air contaminant to be released.

(2) House vacuum should be provided with in-line filters or traps to prevent mechanical contamination. Vacuum pumps should be vented into a hood or ventilation system if used with hazardous chemicals.

g. Prohibited Devices. Ductless fume and auxiliary air hoods are not permitted.

11. Administrative and Work Practice Controls.

a. General.

(1) High risk laboratory operations shall not be left unattended overnight or conducted without prior approval from the ECBC Risk Reduction Office.

(2) The availability of medical support for chemical agent operations shall be confirmed by laboratory personnel daily.

b. Signs and Labels.

(1) Laboratory supervisors shall post STEAP-FE Form 104R [NOTICE (SOP 420-1)] at the entrance to each laboratory room. The form shall list the room custodian along with telephone numbers for both work and home.

(2) Post warnings at areas or equipment where special or unusual hazards exist (i.e., carcinogens, reproductive toxins, substances which have high degree of acute toxicity, confined spaces, lasers).

(3) Areas using toxins will be labeled with a sign, which states “Caution- Toxins in Use” during operations. A Universal Biohazard sign will be posted on all entrances to the room and labeled to indicate the use of toxins.

c. Handling Chemicals.

(1) Working quantities of hazardous chemicals outside of storage during an operation shall be kept to a minimum. Containers shall be closed when not in use.

(2) Care should be taken to minimize aerosol formation during complex manipulations. Electrostatic powders and other solid materials shall be handled in solution whenever feasible. Glove boxes or glove bags inside a chemical hood may be required on a case-by-case basis.

(3) Mouth pipetting is prohibited.

d. Laboratory Glassware.

(1) Glassware should be inspected before each use. Damaged items shall be repaired or discarded in containers designated "Glass Only."

(2) Glassware used for pressure or vacuum service shall be designed specifically for that purpose. Damaged or repaired glassware should not be used for pressure or vacuum operations. Pressure or vacuum operations shall be adequately shielded.

(3) Broken glass shall not be handled directly be hand. Tongs, forceps, or a dustpan and broom shall be used to clean up the glass.

e. Chemical Hoods. The following work practices shall be used to ensure adequate hood performance:

(1) Laboratory Hoods shall be appropriately certified for the chemicals in use during the operation.

(2) Work with the hood sash opened to the established hood certified height during the operation. Do not place your head inside the hood.

(3) Keep all apparatus and containers at least 20 centimeters (8 inches) behind the face to maximize containment for surety hoods unless there is an approved exemption from the RRO. This is a CA requirement. Bio toxins are not required to be behind the 20cm line. This is a recommendation only.

(4) Keep the slot in front of the lower hood baffle free from obstructions; e.g., spill trays. Elevate all necessary apparatus and equipment.

(5) Minimize the storage of chemicals or hazardous waste inside the hood. Use approved cabinet or satellite storage locations.

(6) Minimize pedestrian traffic past the open face of the hood. This may cause spillage of contaminants.

(7) Keep laboratory doors closed at all times.

12. Protective Clothing and Equipment.

a. Eye Protection. Eye protection shall meet the requirements of ANSI Standard Z87.1 (latest edition).

(1) Eye protection suitable for the operation being conducted shall be worn in all laboratories where hazardous chemicals are being handled. Safety glasses shall be considered the minimum eye protection to be used in the laboratory. Chemical goggles shall be worn during operations where a splash hazard exists or where corrosives are used.

(2) Face shields shall be worn when additional eye/face protection is necessary against splash or projectiles. Face shields shall be used in combination with approved eye protection.

(3) Contact lenses can only be worn with safety goggles, a NIOSH approved respirator, or M40 military mask, used for escape purposes only, by visitors and casuals. Optical inserts are required for all others.

(4) Visitors shall comply with the above requirements.

b. Gloves. Gloves shall be worn to minimize potential skin contact with hazardous chemicals. If needed, contact the CHO for guidance.

(1) The following glove discipline shall be followed for non-surety operations:

(a) Proper protective gloves should be worn whenever the potential for contact with hazardous chemicals and toxins exists.

(b) Gloves should be selected on the basis of the material being handled, the particular hazards involved, electrostatic sensitivity, and their suitability for the operation being conducted. Contact the Risk Reduction Office for guidance in glove choice.

(c) Before each use, gloves should be inspected for discoloration, punctures, and tears. A leak test shall be performed to identify pinholes. Damaged or leaking gloves shall be discarded.

(d) Before removal, non-disposable gloves should be washed according to the manufacturer's recommendations. (NOTE: Some gloves, e.g., leather and polyvinyl alcohol, are water permeable and should not be washed.) If you have further questions, please contact the Risk Reduction Office.
Disposable gloves shall be removed in such a way that skin does not come in contact with potentially contaminated surfaces.

(e) Glove materials are eventually permeated by chemicals. However, they can be used safely for limited time periods if specific use and glove characteristics are known. Contact the Risk Reduction Office for guidance.

(f) Gloves will be replaced periodically, depending on frequency of use and permeability to the substance(s) handled. Gloves overtly contaminated (if impermeable to water) should be rinsed and then carefully removed. Disposable gloves shall be changed at the end of an operation, before proceeding from one level of containment to another, when overtly contaminated, and at the end of the work day.

(2) Glove policy for chemical agent operations will be IAW DA PAM 385-61.

(3) Insulated gloves shall be used to prevent contact with hot or cold surfaces. Asbestos containing gloves shall not be used.

c. Clothing

(1) Personnel shall remove and have laundered, or dispose of garments if they have been contaminated. Under no circumstances should lab coats or other laboratory protective clothing be laundered at home. All clothing used with CAs and toxins must be deconned before laundering.

(2) Laboratory personnel shall wear closed-toed shoes. The use of sandals or open-toe shoes is prohibited. Steel-toe or conductive shoes shall be worn when necessary.

(3) Chemical protective clothing including aprons, boots or one-piece suits shall be worn when there is a risk of liquid chemical contamination present. Equipment shall be inspected for cuts, tears and degradation before each use. Decontamination and doffing procedures shall be developed for individual SOPs.

d. Respiratory Protection. Selection and use of respirators shall be IAW 29 CFR, Part 1910.134, 1910.139, and ECBC Regulation 40-1. Military masks shall not be used to provide protection against industrial chemicals.

e. Eyewash/Safety Showers. Design and installation of new equipment shall comply with ANSI Standard Z358.1 (latest edition).

(1) For new construction, an eyewash and safety shower shall be installed IAW ANSI Z358.1. The ECBC Risk Reduction Office shall determine the adequacy of eyewash/safety shower equipment in existing laboratories.

(2) Equipment shall be inspected by the user periodically to determine whether or not it is functional. Eyewashes shall be inspected at least monthly. Safety showers shall be inspected at least semiannually. The AMSSB Form 1024 (Safety Inspection Equipment (TAG) should be attached to the equipment.

(3) Equipment shall be accessible at all times. Personnel shall not store equipment, apparatus or containers in front of an eyewash or safety shower.

13. Air Monitoring.

a. Air monitoring shall be conducted when there is a reasonable probability that employee exposure exceeds the action level for a chemical (or the AEL in absence of an action level). Contact the CHO for coordination with KUSAHC, Industrial Hygiene Section to coordinate air monitoring.

b. If the initial determination indicates employees are exposed above the action level or in its absence the AEL for an Occupational Safety and Health Administration (OSHA) regulated substance, periodic monitoring shall be conducted IAW that particular OSHA standard.

c. Periodic air monitoring may be terminated IAW the requirements for that particular OSHA standard.

d. Employees shall be notified in writing, within 15 calendar days, of monitoring results. Employees may be notified individually or the results may be posted in the work area.

e. Contact the ECBC Environmental Monitoring Laboratory for chemical agent monitoring.

14. Information and Training.

a. Personnel shall be provided with information and training to ensure they are apprised of chemical and toxin hazards in the laboratory. As a minimum, the following health and safety information shall be available:

(1) Contents of the OSHA Laboratory Standard and its appendices are available at the Risk Reduction Office for review.

(2) Location of the CHP. The CHP is available online at: http://cbnet/org/rda/od/ecbc_chp.pdf .

(3) The Risk Reduction Office should be contacted for questions dealing with the availability/application of action levels (AL's) for OSHA regulated substances.

(4) Signs and symptoms associated with exposure to hazardous chemicals and toxins used in the laboratory. The laboratory supervisors provide this training in conjunction with the HAZCOM Program.

(5) Location and availability of reference material including MSDS's.

b. Personnel shall be trained prior to operating under an approved hazardous SOP. Personnel handling hazardous chemicals and toxins shall be trained. As a minimum, training shall include the following (29 CFR, Part 1910.1450):

(1) Methods and observations that may be used to detect the presence of hazardous chemicals.

(2) Physical and health hazards of chemicals and toxins used in the laboratory.

(3) Measures personnel can take to protect themselves from these hazards including use of engineering controls, work practices, personal hygiene and personal protective equipment.

(4) Emergency Response plans

c. Hazardous Waste. Personnel handling hazardous wastes shall be trained in the environmental requirements for its management. As a minimum, training shall include the following:

(1) Resource Conservation and Recovery Act (RCRA) including authority, regulatory framework and general requirements. Initial RCRA training shall be followed annually with refresher training per APGR 200-60.

(2) Site specific information including facility operation, emergency equipment and procedures, inspection procedures, waste minimization and hazardous waste turn-in procedures.

15. Personal Hygiene.

a. Food, drink, smoking materials or cosmetics shall not be carried into, stored, or used in the laboratory where toxic materials may be stored. Personnel shall not eat, drink, smoke, chew gum/tobacco or apply cosmetics in the laboratory.

b. Personnel shall wash their hands after handling hazardous chemicals and toxins. Personnel shall shower after abnormal circumstances, which result in chemical or toxin

contamination to the neck, arms, legs or body. Refer to the worksite SOP for any additional emergency procedures for chemical contamination.

c. Personnel shall restrain long hair and loose clothing to minimize the risk of chemical and toxin contamination.

d. Mouth pipetting is prohibited.

16. First Aid.

a. All laboratory personnel and laboratory supervisors shall have adequate training in signs and symptoms of exposure to relevant chemicals and self-aid/buddy-aid procedures. In addition, all laboratory personnel and laboratory supervisors who work with chemical agent, shall be certified in Cardiopulmonary Resuscitation (CPR) by the American Red Cross or other recognized agency.

b. Emergency telephone numbers and points of contact shall be posted near each laboratory telephone. For severe injury or any chemical, biological, radiological injury, or illness dial 911; report the nature and extent of the emergency and await ambulance transportation. Render the appropriate first aid while awaiting transport. If only minor first aid is required and there is no chemical, biological, or radiological contamination, personnel may be transported to KUSAHC in a private vehicle.

c. Personnel should follow the general first aid procedures IAW the MSDS in the event of chemical or toxin contamination or acute exposure.

d. Bloodborne Pathogens

(1) Employees at ECBC are not considered to be occupationally exposed to bloodborne pathogens since there are currently no operations with human blood or other body fluids. The OSHA Bloodborne Pathogen Program does not cover "Good Samaritan" acts of first aid or other assistance to fellow workers.

(2) The guidance in Appendix F is provided for information purposes only and may be used if you have the potential of being exposed to human body fluids. For additional guidance please contact the Risk Reduction Office.

17. Medical Surveillance.

a. Medical examinations and consultation shall be performed by or under the direct supervision of a licensed physician.

b. Pre-placement, reassignment and periodic job-related medical surveillance shall be provided to all military and civilian employees potentially exposed to hazardous chemicals (AR 40-5), and toxins. The medical examiner must be made aware of all chemicals, toxins and radionuclides to which the operator may be exposed. Potential information, which may preclude

the operator from handling hazardous chemicals, toxins, and radionuclides, must be reported to the supervisor.

c. Additional medical attention shall be provided to employees under the following circumstances:

(1) When an employee develops signs or symptoms associated with occupational exposure to a hazardous chemical or toxin.

(2) When air sampling reveals exposure levels above the action level, or in its absence the AEL, for an OSHA regulated substance. Medical surveillance shall comply with the requirements of that particular standard.

d. Medical consultation shall be provided whenever an abnormal event such as a spill, leak or explosion takes place in the laboratory. Its purpose shall be to determine whether subsequent medical examination is necessary.

e. For medical examinations and consultation required under paragraph c and d, the examining physician shall provide a written opinion that is placed into the patients' confidential medical file. The written opinion should include the following:

(1) Any recommendations for further medical follow-up.

(2) Results of the medical examination and diagnostic tests.

(3) Any medical condition, which may be revealed in the course of the examination that places the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.

(4) A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination.

18. Chemical Waste Disposal.

a. Laboratory wastes shall be handled and disposed of IAW applicable Federal, State and local environmental regulations and policies.

b. Chemicals and toxins shall be handled and stored in such a way that their identity is retained from initial receipt or production to use or ultimate destruction whenever feasible. When chemicals are combined and become part of a laboratory waste mixture, a record of all chemicals in the mixture shall be maintained.

c. Personnel shall minimize the generation of hazardous waste whenever feasible. Common methods of waste minimization include substitution of less hazardous chemicals, process changes, recycling or reuse.

d. Containers holding hazardous waste shall be labeled "HAZARDOUS WASTE." Containers of non-hazardous waste shall be labeled "NONHAZARDOUS."

e. Only designated hazardous waste satellite accumulation sites or 90-day storage facilities shall be used for the accumulation or storage of hazardous waste.

f. Hazardous waste shall be turned in for disposal via the Hazardous Waste Tracking System and IAW APGR 200-60.

g. Non-hazardous chemical waste shall be disposed of IAW existing guidance. If appropriate guidance is not available, a request for assistance shall be forwarded to the ECBC Environmental Quality Office.

19. Chemical and Toxin Spills.

a. General.

(1) The spill of any quantity of a hazardous chemical or toxin, which results in a release to the environment (i.e., air, land or water), or exposure to personnel shall immediately be reported by dialing 911. Laboratory personnel may take action to stop or contain a spill if it can be done without endangering themselves or other personnel. When a spill poses a health hazard all potentially affected laboratories shall be evacuated immediately.

(2) Personnel shall use appropriate protective equipment and clothing to minimize chemical and toxin exposure during spill clean up. Specific requirements shall be documented in the SOP.

(3) Laboratories shall be provided with supplies and equipment to handle small spills. These include absorbents, neutralizers, mops, buckets, dustpans, paper towels, sponges and waste containers.

(4) Spill trays shall be used for all complex operations where there is a reasonable probability a spill could occur.

(5) Laboratory spills shall be reported to the Environmental Quality Office. All waste shall be handled IAW APGR 200-60.

b. Liquid Spills.

(1) Spills should be confined using trays, absorbents or paper towels whenever feasible.

(2) Neutralize inorganic acids and strong bases with an appropriate chemical or use an absorbent mixture (i.e., soda ash or diatomaceous earth). Other liquids should be adsorbed with a non-reactive material such as sand or vermiculite and placed in suitable and properly labeled containers.

(3) Flammable liquids. Turn off or remove all ignition or heat sources. Continuously ventilate the area. Absorb the liquid with a non-reactive material and place in a suitable container.

c. Solid Spills. Low toxicity materials should be swept into a dustpan and placed in a suitable container. Wet methods or high efficiency particulate air (HEPA)-filtered vacuum shall be used to cleanup toxic chemicals. Dry sweeping is prohibited.

20. Emergencies.

a. Emergency Plan. Laboratory operations shall follow the written emergency plan in their SOPs:

(1) Evacuation Procedures. Primary and alternate routes shall be established as necessary, and communicated to personnel. Outside assembly areas shall be designated. Building custodians shall devise a written emergency plan for emergencies that require building evacuation.

(2) Shutdown Procedures. Instructions for shutting down equipment or apparatus in the event of an emergency shall be documented in SOPs.

(3) Return Procedures. Procedures shall be developed to ensure personnel do not re-enter the laboratory before the emergency is over.

(4) Drills. Drills incorporating all elements of the emergency plan shall be conducted with the frequency designated in the plan.

b. Fire. Only personnel trained IAW 29 CFR 1910.157 shall use a fire extinguisher to fight an incipient stage fire.

c. Ventilation Failure. Follow procedures established in the site operation SOP. In cases where the operation could not be terminated and there is a reasonable probability that the laboratory atmosphere is unsafe, air monitoring may be necessary before re-entry. The CHO shall be contacted for guidance. For chemical agent areas, monitoring is required in IAW DA PAM 385-61. The Environmental Monitoring Laboratory shall be contacted for all monitoring in chemical agent areas.

21. Housekeeping.

a. Laboratories shall be kept clean and free from obstructions. Personnel shall clean-up work areas at the end of each day's operations. Chemical and toxin spills shall be cleaned up immediately to minimize contamination.

b. Hazardous waste shall be stored in the satellite accumulation area or a temporary 90-day storage facility in closed, properly labeled containers. Non-hazardous solid and liquid waste shall be stored in appropriate receptacles or containers.

c. Equipment, apparatus and chemical inventories shall be properly stored. Excess equipment and chemicals shall be turned in to minimize clutter in the laboratory.

d. Floors shall be cleaned routinely to minimize re-suspension of dust and toxic contaminants. Wet methods or HEPA-filtered vacuum shall be used for the clean up of dry toxic chemicals and toxins.

e. Stairways and halls shall not be used as storage areas. Access to exits and emergency equipment shall not be blocked.

22. Special Procedures for Handling Acutely Toxic Compounds, Carcinogens and Reproductive Hazards.

a. General. In addition to the hygiene practices covered in the previous paragraphs, the following special procedures are to be used for laboratory operations involving acutely toxic compounds, carcinogens and toxins, including reproductive toxins. Special procedures for CDC/USDA Select Agent toxins are found in Appendix H. A hard copy of the chemical carcinogens lists is available for review in building E3330, room 283 at the Risk Reduction Office . An electronic list of chemical carcinogens covered by this section is found at the following Internet sites:

(1) International Agency for Research on Cancer (IARC) http://193.51.164.11/monoeval/crthall.html
(2) National Toxicology Program http://ntp-server.niehs.nih.gov/Main_pages/NTP_8RoC_pg.html
(3) Occupational Safety and Health Administration (OSHA) http://www.osha-slc.gov/SLTC/carcinogens/index.html
(4) American Conference of Governmental Industrial Hygienists (ACGIH) Appendix G

b. Storage and Distribution.

(1) Acutely toxic compounds, carcinogens and toxins, including reproductive toxins should be segregated from other chemicals and stored in a well-ventilated area. When available, ventilated cabinets shall be used for storage.

(2) Cabinets shall be posted with AMSSB Form 1042 (DANGER - CHEMICAL CARCINOGEN), AMSSB Form 1037 (CAUTION -CANCER SUSPECT AGENT), or AMSSB Form 1026 (CAUTION - TOXIC AGENTS) as appropriate.

(3) Storage of unopened containers presents no special hazards. Once opened, volatile chemicals shall be sealed with parafilm or tape, or overpacked in an unbreakable container.

(4) Acutely toxic compressed gases shall be stored in a chemical hood or gas cabinet. Storage shall be kept to the minimum required to do the work.

(5) Acutely toxic compounds, carcinogens or toxins, including reproductive toxins shall be placed in an unbreakable secondary container prior to transport through the laboratory. The secondary container should contain absorbent material to cushion the primary container and absorb the contents in the event of a spill. Secondary containers shall be appropriately labeled.

c. Engineering Controls.

(1) Laboratory operations, which involve acutely toxic compounds, carcinogens or toxins, including reproductive toxins, shall be planned and conducted using appropriate engineering controls IAW the approved SOP.

(2) Effluent from test equipment or apparatus shall be filtered or scrubbed before discharged into the environment. House vacuum shall be provided with in-line filters or traps to prevent contamination. Vacuum pumps shall be vented into a chemical hood or local ventilation system.

(3) Analytical instrumentation which generates vapor or aerosol contamination shall be vented into a hood or operated using local exhaust ventilation to capture air contaminants unless it can be demonstrated through air monitoring that the concentrations are below the most stringent standard (AEL, PEL, or TLV).

d. Administrative and Work Practice Controls.

(1) Two-Person Rule. High-risk operations may require application of the two-person rule. The Risk Reduction Office, on a case-by-case basis, shall determine requirements. All work with Botulinum toxin will require two person rule.

(2) Designated Area.

(a) Laboratory operations shall be conducted in a "designated area" where access to unauthorized personnel is restricted. The area may be the entire room, an area within the room or the primary containment. Doors leading to the designated area shall remain closed at all times.

(b) Each designated area shall be posted "DANGER - CHEMICAL CARCINOGEN", "CAUTION - CANCER SUSPECT AGENT", “CAUTION – TOXINS”, or "CAUTION - TOXIC AGENTS AUTHORIZED PERSONNEL ONLY" as appropriate.

(3) Working Surfaces. Working surfaces shall be impervious to the hazardous chemicals used in the laboratory. Spill trays should be used when complex manipulations are conducted.

e. Decontamination. Contaminated equipment, apparatus and glassware shall be decontaminated before removal from the designated area. Working surfaces shall be

decontaminated prior to beginning new operations. Acetone, ethanol, or water is recommended for solvent washing when chemical decontamination is not feasible.

f. Animal Work.

(1) Administration of toxicants shall be by injection or oral gavage instead of dietary whenever feasible. If dietary administration must be used, cages should be maintained under negative pressure. The diet shall be mixed in a chemical hood or under local ventilation.

(2) Work practice controls including wet cleaning methods and HEPA filtered vacuums shall be used to minimize the generation of contaminated aerosols, including those from food, urine and feces.

(3) Lab coats/smocks and gloves shall be worn in all animal handling areas. Additional requirements including head and shoe coverings or respiratory protection shall be determined by the CHO on a case-by-case basis.

(4) Laboratory personnel handling animals shall be trained IAW the Guide for the Care and Use of Laboratory animals, which is published by the National Research Council.

23. General Laboratory Safety. Laboratory equipment and apparatus shall be used safely. The Risk Reduction Office shall perform an equipment hazard analysis on all test equipment developed in house.

APPENDIX A
(REFERENCES)
REQUIRED PUBLICATIONS

7 CFR 331 Agricultural Bioterrorism Protection Act of 2002; Possession, Use and Transfer of Biological Agents and Toxins.

9 CFR 121 Agricultural Bioterrorism Protection Act of 2002; Possession, Use and Transfer of Biological Agents and Toxins.

Title 29 (Code of Federal Regulations (CFR), section 1910, Subpart H, Hazardous Materials) cited in paragraph 9.

Title 29 (CFR, section 1910.134, Respiratory Protection) cited in Paragraph 12.

Title 29 (CFR, section 1910.1200, Hazard Communication) cited in Paragraphs 8c, 9c(1).

Title 29 (CFR, section 1910.1450, Occupational Exposure to Hazardous Chemicals Laboratories) cited in paragraph 14.

42 CFR 73 Possession, Use , Transfer of Select Agents and Toxins.

AR 40-5 (Preventive Medicine) cited in paragraphs 5 and 17.

AR 700-68 (Storage and Handling of Compressed Gases and Gas Cylinders) cited in paragraph 9.

AMCR 385-100 (Safety Manual) cited in paragraph 9.

AR 385-61 (The Army Toxic Chemical Agent Safety Program).

DA PAM 385-61 (Toxic Chemical Agent Safety Standards) cited in Paragraph 12.

AR 385-69 (Biological Defense Safety Program).

DAPAM 385-69 (Biological Defense Safety Program)

APGR 200-60 (Environmental Quality Hazardous Waste Management) cited in paragraphs 9, 18 and 19.

APGR 385-4 (APG Safety and Occupational Health Program) cited in

Paragraph 5.

APGR 690-9 (Leave Administration) cited in paragraph 14.

CRDECR 40-1 (Respiratory Protection Program) cited in paragraph 12.

CRDECR 40-2 (Experimental Agent Health Hazards Information Program) cited in paragraph 14.

CRDECR 700-1 (Preventive Maintenance of Toxic Exhaust Ventilating System) cited in paragraph 10

DOD 6050.5-LR (DOD Hazardous Materials Information System: Hazardous Item Listing) cited in paragraph 8.

ANSI Standard Z87.1 (Practice for Occupational and Educational Eye and Face Protection) cited in paragraph 12.

ANSI Standard Z358.1 (Emergency Eyewash and Shower Equipment) cited in paragraph 12.

NFPA Standard 30 (National Fire Protection Association Flammable and Combustible Liquids Code) cited in paragraph 9

NFPA Standard 45 (Standard on Fire Protection for Laboratories Using Chemicals) cited in paragraph 9.

American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation - A Manual of Recommended Practice cited in paragraph 10.

National Research Council - Guide for the Care and Use of Laboratory Animals cited in paragraph 22.

RELATED PUBLICATIONS

Title 26 (Code of Maryland Regulations, subtitle 13, Disposal and Control of Hazardous Substances)

AR 50-6 (Chemical Surety Program)

AR 50-X (Biological Surety Program - draft)

AR 385-10 (The Army Safety Program)

AR 385-64 (Ammunition and Explosives Safety Standards)

CRDECR 385-6 (Ionizing Radiation Program)

DA PAM 40-8 (Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD and VX)

DA PAM 40-173 (Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT)

TB MED 503 (The Army Industrial Hygiene Program)

42 CFR Part 73
9 CFR Part 121
Biosafety in Microbiological and Biomedical Laboratories
AR and DAPam 385-69

APPENDIX B

EXPLANATION OF TERMS

Acutely toxic. A chemical falling within any of the following toxicity categories: (i) a median lethal dose (LD50) of 50 mg/ kg of body weight or less when administered orally to rats, (ii) an LD50 of 200 mg/kg of body weight or less when administered to the skin of rabbits, (iii) a median lethal concentration (LC50) in air of 200 ppm or less of gas or vapor, or mg/liter or less of mist, fume or dust when administered by inhalation to rats.

Action level. A concentration designated in Title 29, Code of Federal Regulations (CFR), part 1910 for a regulated substance that initiates certain required activities such as exposure monitoring and medical surveillance. Also 1/2 of the PEL or TLV for a chemical, whichever is more stringent.

Airborne Exposure Limit (AEL): Allowable concentrations in air for occupational and general population exposure to Chemical Agent Materials.

Biosafety Cabinet. The biological safety cabinet (BSC) is the principal device used to provide containment of infectious splashes or aerosols generated by many microbiological procedures. Three types of BSCs (Class I, II, III) used in microbiological laboratories are described and illustrated in Appendix A. Open-fronted Class I and Class II BSCs are primary barriers which offer significant levels of protection to laboratory personnel and to the environment when used with good microbiological techniques. The Class II BSC also provides protection from external contamination of the materials (e.g., cell cultures, microbiological stocks) being manipulated inside the cabinet. The gas-tight Class III BSC provides the highest attainable level of protection to personnel and the environment.

Carcinogen. A neat chemical or mixture which contains at least 0.1 percent of a chemical which meets one of the following criteria: (i) it is regulated by OSHA as a carcinogen, (ii) it is a human carcinogen listed under the category "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP), latest edition, (iii) it is listed under Group I, "carcinogenic to humans" by the International Agency for Research on Cancer (IARC), latest edition, (iv) it is listed in either Group 2A or 2B by IARC or under the category "reasonably anticipated to be carcinogens" by NTP, (v) it is a military-unique compound classified as a carcinogen by USACHPPM or OTSG, or (vi) it causes statistically significant tumor incidence in experimental animals IAW any of the following criteria:

(a) After inhalation exposure of 6-7 hours per day, 5 days per week for a significant portion of a lifetime to doses less than 10 mg/cubic meter, or

(b) After repeated skin application of less than 300 mg/kg of body weight per week, or

(c) After oral doses of less than 50 mg/kg of body weight per day.

A list of chemical carcinogens meeting the criteria in paragraphs (i) through (v) is at appendix G.

Chemical Hygiene Officer. The employee designated by the Director, ECBC, who is qualified by training and/or experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.

Chemical Hygiene Plan. A written program developed and implemented by ECBC, which sets forth policy and procedures capable of protecting employees from the health hazards associated with their work place.

Chemical Agent. A chemical compound intended for use (to include experimental compounds) in military operations to kill, seriously injure, or incapacitate persons through its physiological effects. Excluded are RDTE solutions, riot control agents, chemical defoliants and herbicides, smoke, flame and incendiaries, and industrial chemicals.

Combustible liquid. Any liquid having a flash point at or above 100 degrees Fahrenheit (F), but below 200 degrees F, except any mixture having components with flash points of 200 degrees F or higher, the total volume of which makes up 99 percent or more of the mixture.

Compressed gas. A gas or mixture of gases having an absolute pressure exceeding 40 psi at 70 degrees F, or a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 degrees F regardless of the pressure at 70 degrees F.

Designated area. An area, which may be used for work involving carcinogens, reproductive toxins or acutely toxic chemicals. A designated area may be the entire laboratory, a controlled area within the laboratory or engineering controls such as a chemical hood or glove box.

Emergency. Any occurrence such as, but not limited to, equipment failure, container rupture or engineering control failure, which results in the release of a hazardous chemical into the work place.

Employee. An individual employed in a laboratory who may be exposed to hazardous chemicals in the course of his/her employment.

Explosive. A chemical that causes a sudden, almost instantaneous release of pressure, gas and heat when subjected to sudden shock, pressure or high temperature.

Flammable aerosol. An aerosol that when tested by the method described in Title 16, CFR part 1500.45 yields flame protection exceeding 18 inches at full valve opening, or a flashback at any degree of valve opening.

Flammable gas. A gas that, at ambient temperature and pressure forms a flammable mixture with air at a concentration of 13 percent by volume or less, or a gas that at ambient temperature and pressure forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

Flammable liquid. A liquid having a flash point below 100 degrees F, except any mixture having components with flash points of 100 F or higher, the total of which makes up 99 percent or more of the total volume of the mixture. Also known as a Class I liquid. These are further divided into (i) Class 1A which includes liquids having flash points below 73 degrees F and boiling points below 100 degrees F, (ii) Class 1B which includes liquids having flash points below 73 degrees F and boiling points at or above 100 degrees F and, (iii) Class 1C which includes liquids having flash points at or above 73 degrees F but below 100 degrees F.

Flash point. The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested using the Tagliabue Closed Tester, the Pensky-Martens Closed Tester or the Setaflash Closed Tester.

Hazardous chemical. A chemical for which there is statistically significant evidence based on at least one study conducted IAW established scientific principles that acute or chronic health effects may occur in an exposed employee. This includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic (blood-forming) systems, and agents which can damage the lungs, skin, eyes or mucous membranes.

High Risk Operations. Experimental procedures involving the manipulation, handling or reaction of hazardous chemicals where the potential for release of gas, vapor or aerosol contamination is high. This category includes but is not limited to (i) rapid exothermic reactions, (ii) transfer of electro-static powders, (iii) heating, mixing or transfer of volatile chemicals, (iv) pressurized operations where there is potential for uncontrolled release, and (v) work involving aerosol generation.

Laboratory. A facility, building or individual room where the "laboratory use" of hazardous chemicals or hazardous waste is used, stored, or disposed of.

Laboratory hood. A type of engineering control enclosed on five sides with a movable sash or fixed partial enclosure on the remaining side designed to draw air from the laboratory into the enclosure to prevent or minimize the escape of contaminants into the laboratory space.

Laboratory scale. Work with substances in which the equipment used for reactions, transfers, and other handling are designed to be easily and safely manipulated by one person.

Laboratory use. The handling or use of chemicals in which: (i) chemical manipulations are done on a "laboratory scale," (ii) multiple procedures or chemicals are used, (iii) procedures are not part of a production process, and (iv) "protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Low Risk Operations. Experimental procedures where the potential for release of gas, vapor or aerosol contamination is remote.

Medical consultation. A consultation which takes place between an employee and a licensed physician for the purposes of determining what medical examination or procedures are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Overpack. To pack chemicals designated for turn in IAW APGR 200-60 in an open head DOT. Specification metal shipping container (4a CFR Parts 178 and 179) of no more than 416 liter (110 gallon) capacity and surrounded by, at a minimum, a sufficient quantity of absorbent material to completely absorb all of the liquid contents of the inside containers. (Also known as lab packs.)

Oxidizer. A chemical other than a blasting agent or explosive as defined in Title 29 CFR, part 1910.109 (a), that initiates or promotes combustion in other material, thereby causing fire either by itself or through the release of oxygen or other gases.

Permissible Exposure Limit. An occupational standard promulgated by OSHA as a regulatory requirement. The PEL can be an 8-hour TWA, a ceiling value or a 15-minute STEL. A list of PELs is available at the Risk Reduction Office.

Protective laboratory practices and equipment. Those laboratory procedures, engineering/administrative controls, work practices and protective clothing and equipment used to minimize employee exposure to hazardous chemicals.

Reproductive Hazard. A chemical, which affects the reproductive system and may produce chromosomal damage (mutations) and/or adverse effects on the fetus (teratogenesis). For the purposes of this guidance any chemical with a mutagenic or teratogenic quotation in the Registry of Toxic Effects of Chemical Substances (RTECS) shall be considered a reproductive hazard.

Threshold Limit Value® (TLV). Airborne concentrations of substances published by the American Conference of Governmental Industrial Hygienists® to which it is believed workers may be exposed day after day with no adverse effect. The TLV's are advisory in nature, however, DA policy uses the TLV as regulatory policy when they are more stringent than the PEL for a specific chemical. A list of TLV's is found at Appendix C.

Toxic chemical. A chemical falling within any of the following toxicity categories: (I) an LD50 of more than 50 mg/kg but not more than 500 mg/kg of body weight when administered orally to rats, (ii) an LD50 of more than 200 mg/kg but not more than 1000 mg/kg of body weight when administered to the skin of rabbits, (iii) an LC50 in air of more than 200 ppm but not more than 2000 ppm of gas or vapor, or more than 2 mg/liter but not more than 20 mg/liter of mist, fume or dust when administered by inhalation to rats. (Also see Acutely Toxic Chemical)

Toxin. Toxic material of biologic origin that has been isolated from the parent organism; the toxic material of plants, animals or microorganisms.

Two Person Rule. A system designed to prohibit access by one individual to the toxin by requiring the presence at all times of at least two authorized personnel, each capable of

performing first aid in the case of an exposure or detecting incorrect or unauthorized procedures with respect to the task being performed.

APPENDIX C

STORAGE CODES

Storage Code	Compatibility Category
1	Acids - Inorganic acids
2	Caustics - Any strongly alkaline material which has a corrosive or irritating effect on living tissue.
3	Organics - A compound that contains the element carbon, with the exception of carbon dioxide or compounds containing the carbonate radical.
4	Inorganics - A compound which does not contain the element carbon. This group includes compounds with the carbonate radical.
5	Oxidizers - A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials.
6	Water Reactive - A compound that reacts violently with water.
7	Toxic - A chemical that is acutely toxic, or a carcinogen or reproductive hazard.
8	Flammable - A liquid or solid meeting any of the definitions in Appendix B.
9	Organic Peroxide - An organic

compound that contains the bivalent O-O structure, which may be considered to be a derivative of hydrogen peroxide.

APPENDIX D

WATER REACTIVE CHEMICALS

acetic anhydride
acetyl bromide
acetyl chloride
alkyl aluminum chloride
allyl trichlorosilane
aluminum aminoborohydride
aluminum borohydride
aluminum bromide
aluminum chloride
aluminum diethyl monochloride
aluminum fluoride
aluminum hypophosphide
aluminum phosphide
antimony chloride
antimony fluoride
antimony tribromide
antimony trichloride
antimony trifluoride
antimony triiodide
antimony trivlnyl
arsenic bromide
arsenic chloride
arsenic iodide
arsenic tribromide
arsenic trichloride
arsenic triiodide
barium
barium carbide
barium hydride
barium monoxide
barium oxide
barium sulfide
benzene diazonium chloride
benzene phosphorus dichloride
benzol chloride
benzyl silane
beryllium hydride
beryllium tetrahydroborate
bismuth pentafluoride
borane
bromine monofluoride

bromine pentafluoride
bromine trifluoride
bromodiethylaluminum
n-butyl lithium
butyl trichlorosilane
cadmium acetylide
cadmium amide
calcium carbide
calcium hydride
calcium oxide
calcium phosphide
cesium amide
cesium hydride
cesium phosphide
chlorine monofluoride
chlorine pentafluoride
chlorine trifluoride
chloroacetyl chloride
chloro chromic anhydride
chlorodiisobutyl aluminum
chlorophenol isocyanate
chromyl chloride
copper acetylide
cyclohexenyl trichlorosilane
cyclohexyl trichlorosilane
diethylaluminum chloride
decahydronaphthalene
diphenylmethane
diisocyanate
disulfuryl chloride
dodecyl trichlorosilane
ethyl dichloroarsine
ethyl dichlorosilane
ethyl trichlorosilane
fluorine
fluorine monoxide
gold acetylide
hexadecyl trichlorosilane
hexahydride diborane
hexyl trichlorosilane
boron bromdiiodide
boron dibromoiodide
boron phosphide boron tribromide
boron trichloride
boron trifluoride
boron triiodide

lithium peroxide
lithium silicon
methyl aluminum sesquibromide
methyl aluminum sesquichloride
methyl dichlorosilane
methylene diisocyanate
methyl isocyanate
methyl magnesium bromide
methyl magnesium chloride
methyl magnesium iodide
methyl trichlorosilane
nack (sodium-potassium alloy)
nickel antimonide
nonyl trichlorosilane
octadecyl trichlorosilane
octyl trichlorosilane
oxygen difluoride
phenyl trichlorosilane
phosphonium iodide
phosphoric anhydride
phosphoric sulfide
phosphorus (red)
phosphorus oxybromide
phosphorus oxychloride
phosphorus pentachloride
phosphorus pentasulfide
phosphorus pentoxide
phosphorus sesquisulfide
phosphorus tribromide
phosphorus trichloride
phosphorus trisulfide
phosphoryl bromide
phosphoryl chloride
polyphenyl
polymethylisocyanate
potassium
potassium hydride
potassium oxide
propyl trichlorosilane
pyrosulfuryl chloride
silicochloroform
silicon tetrachloride
silicon tetrafluoridehydrogen bromide
iodine monochloride
lithium
lithium aluminum hydride

lithium amide
lithium ferrosilicon
lithium hydride
sodium monoxide
sodium oxide
sodium peroxide
sodium potassium alloy
stannic chloride
sulfonyl chloride
sulfonyl fluoride
sulfur chloride
sulfuric acid
sulfuric anhydride
sulfur monochloride
sulfur oxychloride
sulfur pentafluoride
sulfur trioxide
sulfuryl chloride
sulfuryl fluoride
tetraphosphorus trisulfide
thionyl chloride
thiocarbonyl chloride
thiophosgene
thiophosphoryl chloride
tin tetrachloride
titanic chloride
titanium tetrachloride
toulene diisocyanate
tri-n-butylaluminum
trichloroborane
trichlorosilane
triethyl aluminum
triethyl antimony
triethyl arsine
triethyl stibine
triisobutyl aluminum
trimethyl aluminum
trimethyl arsine
trimethylstibine
tri-n-butylborane
tripropyl stibine
trisilyl arsine
trivinyl stibine
vanadium trichloride
vinyl trichlorosilanesilver acetylide
slaked lime

sodamide sodium
sodium
sodium aluminum hydride
sodium amide
sodium hydroxide
sodium methylate
sodium methoxide
zinc acetylide
zinc dioxide
zinc ethyl
zinc peroxide

APPENDIX E

SHOCK SENSITIVE CHEMICALS

acetylides (heavy metal)
aluminum ophorite
amatol
ammonal
ammonium nitrate
ammonium perchlorate
ammonium picrate
ammonium salt lattice
butyl tetryl
calcium nitrate
copper acetylide
cyanuric triazide
cyclotrimethylene trinitramine
cyclotetramethylene
trinitramine
dinitroethyleneurea
dinitoglycerine
dinitrophenol
dinitrophenolates
dinitrophenyl hydrazine
dinitrotoluene
dipicryl sulfone
dipicrylamine
erythritol tetranitrate
fulminate of mercury
fulminate of silver
fulminating gold
fulminating mercury
fulminating silver
gelatinized nitrocellulose
germane
guanyl nitrosamino guanyl
tetrazene
guanyl nitrosamino guanylidene
hydrazine
heavy metal azides
hexanite
hexanitrodiphenylamine
hexanitrostilbene
hexogen
hyrazinium nitrate

hyrazoic acid
magnesium ophorite
mannitol hexanitrate
mercury oxalate
mercury tartrate
mononitrotoluene
nitrated carbohydrate
nitrated glucoside
nitrated polyhedric alcohol
nitrogen trichloride
nitrogen triiodide
nitroglycerin
nitroglycide
nitroglycol
nitroguanidine
nitroparaffins
nitronium perchlorate
nitrourea
organic amine nitrates
organic nitramines
organic peroxides
picramic acid
picramide
picratol
picric acid
picryl chloride
picryl fluoride
polynitro aliphatic compounds
potassium nitroaminotetrazole
silver acetylide
silver azide
silver styphnate
silver tetrazene
sodatol
sodium amatol
sodium dinitro-ortho-cresolate
sodium picramate
syphnic acid
tetrazene
tetranitrocarbazole
tetrytol
trimonite
lead azide
lead mannite
lead mononitroresorcinate
lead picrate lead salts

lead styphnate
perchloric acid
trinitroanisole
trinitrobenzene
trinitrobenzoic acid
trinitrocresol
trinitro-meta-cresol
trinitronaphthalene
trinitrophenetol
trinitrophloroglucinol
trinitroresorcinol
tritonal
urea nitrate

NOTE: No attempt has been made to list all shock sensitive chemicals. Laboratory personnel shall review health and safety data including MSDS's to determine whether compounds are shock sensitive.

Appendix F

Universal Precautions for the Handling of Human Body Fluids

Universal precautions are:

- A concept of infection control that requires all human blood and some other potentially infectious materials (OPIM) to be treated as if they are infectious with Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), or other blood borne pathogens (BBP) regardless of the perceived "low risk" of a patient or patient population.

- OSHA's accepted method of control to protect employees from exposure to all human blood and OPIM.

Universal precautions require:

- Routine use of appropriate PPE (gloves, masks, protective eyewear, gowns, etc.)

- Immediate washing of hands and other skin surfaces if contaminated with blood or OPIM. Hands must also be washed immediately after glove removal.

Occupationally exposed employees must use universal precautions and must handle all blood and certain body fluids as infectious.

See table 3 for identified blood and other body fluids (referred to as OPIM) to which universal precautions apply.

Universal precautions also apply to:

- All body fluids in situations where it is difficult or impossible to differentiate between body fluid types.

- Any unfixed tissue or organ other than intact skin from a human (living or dead).

- HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing cultures or other solutions-as well as blood, organs, or other tissues-from experimental animals infected with HIV or HBV.

Table 3
Application of Universal Precautions to Blood and Body Fluids

Body Fluids to Which Universal Precautions Apply	Body Fluids to Which Universal Precautions May Not Apply*
blood	nasal secretions
body fluids containing visible blood	sputum
saliva in dental settings	sweat
semen	tears
vaginal secretions	vomitus
tissues	feces

* Unless these body fluids contain visible blood and/or are encountered in situations where it is difficult or impossible to differentiate between body fluids.

Personal Hygiene:

Provide readily accessible hand washing facilities to all employees. Employees must wash their hands and any other skin with soap and water, or flush mucous membranes with water, immediately after:

- Contact with blood or OPIM.

- Removal of gloves after each patient.

- Removal of other PPE.

If hand washing facilities are unavailable as is the case with ambulance-based paramedics, emergency medical technicians, firefighters, and mobile blood collection personnel/employees

may wipe their hands with a clean cloth or paper towel in conjunction with an antiseptic waterless hand cleanser or antiseptic towelette. However, employees must wash their hands with soap and water as soon as feasible.

Employees may use hand cream from individual, non-refillable containers if they thoroughly wash their hands immediately before application. Employees should not use petroleum-based (Vaseline) creams because they adversely affect glove integrity.

Sharps Management

Sharps not only includes needles and scalpels, but also include anything that might produce a puncture wound that would expose employees to blood or OPIM, such as the ends of contaminated orthodontia wires or broken glass.

Employees must not:

- Shear, break, or bend contaminated sharps.

- Recap or remove contaminated sharps unless no alternative is feasible.

Immediately after use, employees must place contaminated reusable sharps into appropriate containers until properly reprocessed. These containers must be:

- Puncture resistant.

- Labeled or color-coded.

- Leak-proof on both the sides and bottom.

- Locked in place or maintained under direct observation to prevent misuses or access by unauthorized persons.

- Filled only to 3/4 full.

- Stored or processed so employees do not reach by hand into the containers to retrieve instruments.

Collection, Handling, Processing, Storage, Transport, and Shipping of Infectious Materials and Sharps.

Containers used for the collection, handling, processing, storage, transport, or shipping of blood or OPIM must be:

- Puncture resistant.

- Leak proof.

- Labeled or color-coded.

- Closed.

Requirements for the containerization and labeling of specimens:

- Eliminate or minimize possible inadvertent employee contact with blood or OPIM that has leaked out of the container and contaminated exterior surfaces of the container or surrounding surfaces.

- If the first container could be punctured by its contents, it must be placed in a second container that is puncture resistant.

- Warn employees through labeling or color-coding that blood or OPIM are present so that proper handling precautions can be taken.

Gloves.

Gloves provide a barrier to blood and OPIM, but neither vinyl nor latex procedure gloves are completely impermeable. Hand washing is required after glove removal.

Employees must wear gloves when they anticipate:

- Contacting blood or OPIM or mucous membranes.

- Handling or touching contaminated items or surfaces.

- Performing invasive procedures.

- Examining abraded or non-intact skin.

- Rendering emergency medical or non-medical assistance to individuals sustaining traumatic injury.

There are two kinds of gloves used by employees: disposable and reusable. Disposable gloves must be replaced once used, contaminated, torn, or punctured. They must never be washed or decontaminated for reuse.
Reusable gloves may be decontaminated for re-use if the effectiveness of the glove as a barrier against potentially infectious materials is not compromised. However, reusable gloves must be discarded if they are cracked, peeling, torn, punctured, or show any other signs of deterioration.

Instruct employees not to touch telephones, computer keyboards, charts, elevator buttons, or other non-contaminated surfaces with gloved hands or used gloves.

Regulated Waste.

The term "regulated waste" (also known as regulated medical waste, infectious waste, and infective waste) refers to the following categories of waste requiring specific handling:

- Contaminated sharps.

- Liquid or semi-liquid blood or OPIM.

- Items contaminated with blood or OPIM that would release these substances in a liquid or semi-liquid state if compressed.

- Items caked with dried blood or OPIM and capable of releasing these materials during handling.

- Pathological and microbiological wastes containing blood or OPIM.

Regulated waste must be discarded in a designated container.

Contaminated sharps. Contaminated sharps must be discarded in containers that are:

- Closable

- Puncture resistant

- Leak-proof on sides and bottom

- Properly labeled or color-coded

Other regulated waste. Regulated waste must be placed in containers that are:

- Closable.

- Constructed to prevent leakage.

- Properly labeled or color-coded.

Contaminated laundry. Reducing the amount of manual handling of contaminated laundry minimizes employee exposure to blood and OPIM. Limit the handling of laundry during bagging or containerization prior to washing. Restricting the sorting to the laundry area also reduces contamination of additional surfaces.

Employees must:

- Handle contaminated laundry as little as possible with minimum of agitation.

- Bag or containerize contaminated laundry at the location where it was generated.

- Not sort or rinse contaminated laundry in the location where it was generated.

- Properly label or color-code bags or containers of contaminated laundry.

- Place contaminated wet laundry in bags or containers that prevent soak-through or leakage.

- Wear appropriate PPE, including gloves, eye protection, disposable head covers, disposable shoe covers, and plastic aprons when handling contaminated laundry.

- Be provided with easily accessible sharps containers in laundries for the disposal of sharps found in linen.

Appendix G

American Conference of Governmental Industrial Hygienist (ACGIH) Compilation of Carcinogenic Status

Carcinogen Designations from the American Conference of Governmental Industrial Hygienists (ACGIH), Inc. *1998 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*. Note: the TLV/BEI Booklet is updated annually.

DESIGNATIONS

A1: Confirmed Human Carcinogen: Agent is carcinogenic to humans based on epidemiologic studies of, or convincing clinical evidence in, exposed humans.

A2: Suspected Human Carcinogen: Agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) considered relevant to worker exposure. Available epidemiologic studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans.

A3: Animal Carcinogen: Agent is carcinogenic in experimental animals at relatively high doses, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routs or levels of exposure.

A4: Not Classifiable as a Human Carcinogen: Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.

A5: Not Suspected as a Human Carcinogen: Not suspected to be a human carcinogen on the basis of properly conducted epidemiologic studies in humans. Studies have sufficiently long follow-up, reliable exposure histories, sufficiently high dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data.

Substances for which no human or experimental animal carcinogenic data have been reported are assigned no carcinogen designation.

Exposures to carcinogens must be kept to a minimum. Workers exposed to A1 carcinogens without a TLV should be properly equipped to eliminate to the fullest extent possible all exposure to the carcinogen. For A1 carcinogens with a TLV and for A2 and A3 carcinogens, worker exposure by all routes should be carefully controlled to levels as low as reasonably achievable below the TLV.

Acetaldehyde	A3	
Acetone		A4
Acetonitrile		A4
Acrolein		A4
Acrylamide		A3
Acrylic acid		A4
Acrylonitrile		A2
Aldrin		A3
Allyl chloride		A3
Allyl glycidyl ether		A4
Aluminum oxide		A4
4-Aminodiphenyl		A1
Amitrole		A3
Ammonium perfluorooctanoate		A3
Aniline and homologues		A3
o-Anisidine		A3
p-Anisidine		A4
Antimony trioxide production	A2	
ANTU		A4
Arsenic, elemental		A1
Asbestos, all forms		A1
Asphalt (petroleum) fumes		(A4)
Atrazine		A4
Azinphos-methyl		A4
Barium and soluble compounds, as Ba		A4
Benomyl		A4
Benz[a]anthracene		A2
Benzene		A1
Benzidine		A1
Benzo[b]fluoranthene	A2	
Benzo[a]pyrene		A2
Benzotrichloride		A2
Benzoyl chloride		A4
Benzoyl peroxide		A4
Benzyl acetate	A4	
Benzyl chloride		A3
Beryllium and compounds, as Be		A1
Bismuth telluride, as Bi2Te3		
Undoped		A4
Se-doped		A4
Bromacil		A3
Bromoform		A3
1,3-Butadiene	A2	
tert-Butanol		A4
n-Butyl acrylate		A4

Cadmium, elemental, and compounds, as Cd	A2	
Calcium chromate, as Cr		A2
Calcium cyanamide		A4
Calcium silicate (synthetic)		A4
Camphor, synthetic		A4
Caprolactam		
(Particulate)	(A4)	
(Vapor)		(A4)
Captafol		A4
Captan	A3	
Carbaryl		A4
Carbofuran		A4
Carbon black		A4
Carbon tetrachloride (Tetrachloromethane)	A2	
Catechol		A3
Chlordane		A3
Chlorinated camphene (Toxaphene)	A3	
Chlorine		A4
2-Chloroacetophenone		A4
Chlorobenzene		A3
o-Chlorobenzylidene malononitrile	A4	
Chlorodifluoromethane		A4
Chlorodiphenyl (54% chlorine)		A3
Chloroform		A3
bis(Chloromethyl) ether		A1
Chloromethyl methyl ether		A2
Chloropicrin		A4
Chlorpyrifos		A4
Chromite ore processing (Chromate), as Cr	A1	
Chromium, metal and inorganic compounds, as Cr		
Metal and Cr III compounds		A4
Water-soluble Cr VI compounds, NOC(d)	A1	
Insoluble Cr VI compounds, NOC(d)		A1
Chrysene		A3
Clopidol		A4
Coal dust		
Bituminous	(A4)	
Anthracite		(A4)
Coal tar pitch volatiles, as benzene solubles	A1	
Cobalt, inorganic compounds, as Co	A3	
Crotonaldehyde		A3
Crufomate		A4
Cyclohexanone		A4
Cyclohexylamine		A4
Cyclonite		A4
Cyhexatin		A4

2,4-D		A4	
DDT (Dichlorodiphenyltrichloroethane)		A3	
Diazinon		A4	
Diazomethane	A2		
2,6-Di-tert-butyl-p-cresol [Butylated hydroxytoluene (BHT)]			A4
Dichloroacetylene		A3	
o-Dichlorobenzene		A4	
p-Dichlorobenzene		A3	
3,3'-Dichlorobenzidine		A3	
1,4-Dichloro-2-butene	A2		
Dichlorodifluoromethane		A4	
1,1-Dichloroethane		A4	
Dichloroethyl ether		A4	
1,3-Dichloropropene	A4		
Dichlorotetrafluoroethane		A4	
Dichlorvos		A4	
Dicrotophos		A4	
Dieldrin		A4	
Diethylamine		A4	
Di(2-ethylhexyl)phthalate (DEHP)		A3	
Diglycidyl ether (DGE)		A4	
N,N-Dimethylacetamide		A4	
Dimethylamine		A4	
Dimethylaniline (N,N-Dimethylaniline)		A4	
Dimethyl carbamoyl chloride	A2		
Dimethylformamide		A4	
1,1-Dimethylhydrazine		A3	
Dimethyl sulfate		A3	
Dinitolmide		A4	
Dinitrotoluene	A3		
1,4-Dioxane		A3	
Dioxathion		A4	
Diphenylamine		A4	
Diquat		A4	
Diuron		A4	
Endosulfan		A4	
Endrin		A4	
Enflurane		A4	
Epichlorohydrin		A3	
EPN		A4	
Ethanol		A4	
Ethyl acrylate	A4		
Ethyl bromide	A3		
Ethyl chloride	A3		
Ethylene		A4	
Ethylene chlorohydrin	A4		

Ethylenediamine		A4
Ethylene dibromide		A3
Ethylene dichloride		A4
Ethylene glycol, aerosol		A4
Ethylene oxide		A2
Ethylenimine		A3
Fenamiphos		A4
Fensulfothion	A4	
Fenthion		A4
Febram		A4
Fluorides, as F	A4	
Fonofos		A4
Formaldehyde	A2	
Furfural		A3
Gasoline		A3
Glycidol		A3
Halothane		A4
Heptachlor		A3
Hexachlorobenzene		A3
Hexachlorobutadiene	A3	
Hexachlorocyclopentadiene	A4	
Hexachloroethane		A3
Hexamethyl phosphoramide	A3	
Hydrazine		A3
Hydroquinone	A3	
Iron oxide dust & fume, as Fe	A4	
Isophorone		A3
Kaolin		A4
Lead, organic compounds, as Pb		A3
Lead chromate, as Pb	A2	
, as Cr	A2	
Lindane		A3
Malathion		A4
Mercury, inorganic forms including metallic mercury		A4
Methomyl		A4
Methoxychlor		A4
Methyl acrylate		A4
Methyl tert-butyl ether (MTBE)		A3
Methyl chloride		A4
Methyl chloroform		A4
Methylene chloride (Dichloromethane)		A3
4,4’-Methylene bis(2-chloroaniline) [MBOCA; MOCA]		A2
4,4’-Methylene dianiline		A3
Methyl hydrazine		A3
Methyl methacrylate		A4
Methyl parathion		A4

Metribuzin		A4
Monocrotophos		A4
Morpholine		A4
Naled		A4
Naphthalene		A4
B-Naphthylamine		A1
Nickel		
Elemental/metal		A5
Soluble compounds, as Ni	A4	
Insoluble compounds, as Ni		A1
Nickol subsulfide		A1
Nitrapyrin		A4
p-Nitroaniline		A4
Nitrobenzene		A3
p-Nitrochlorobenzene	A3	
4-Nitrodiphenyl		A2
Nitrogen dioxide		A4
1-Nitropropane		A4
2-Nitropropane		A3
N-Nitrosodimethylamine		A3
Nitrous oxide		A4
Parathion		A4
Pentachloronitrobenzene		A4
Pentachlorophenol		A3
Perchloroethylene (Tetrachloroethylene)		A3
Perlite		A4
N-Phenyl-beta-naphthylamine		A4
o-Phenylenediamine	A3	
m-Phenylenediamine	A4	
p-Phenylenediamine	A4	
Phenylhydrazine		A3
Phthalic anhydride		A4
Picloram		A4
Propane sultone		A3
B-Propiolactone		A3
Propoxur		A3
Propylene		A4
Propylene dichloride	A4	
Propyleneimine		A3
Propylene oxide		A3
Pyrethrum		A4
Resorcinol		A4
Rholdium		
Metal		A4
Insoluble compounds, as Rh		A4
Soluble compounds, as Rh	A4	

Ronnel	A4	
Rotenone		A4
Rouge		A4
Sesone	A4	
Silicon carbide		A4
Sodium azide		
As Sodium azide		A4
As Hydrazoic acid vapor		A4
Sodium bisulfite		A4
Sodium metabisulfite	A4	
Starch		A4
Stearates		A4
Strontium chromate		A2
Styene, monomer		A4
Sucrose		A4
Sulfotep		A4
Sulfur dioxide	A4	
Sulfuric acid contained in strong inorganic acid mists		A2
Sulprofos		A4
Synthetic Vitreous Fibers		
Continuous filament glass fibers	A4	
Continuous filament glass fibers	A4	
Glass wool fibers		A3
Rock wool fibers		A3
Slag wool fibers		A3
Special purpose glass fibers		A3
2,4,5-T	A4	
Talc (containing no asbestos fibers)	A4	
1,1,2,2-Tetrachloroethane		A3
Tetraethyl lead		A4
Tetranitromethane		A3
Tin, Organic compounds, as Sn		A4
Titanium dioxide		A4
o-Tolidine		A3
Toluene		A4
Toluene-2,4-diisocyanate (TDI)		A4
o-Toluidine		A3
m-Toluidine		A4
p-Toluidine		A3
Trichloroacetic acid		A4
1,1,2-Trichloroethane	A4	
Trichloroethylene		A5
Trichlorofluoromethane		A4
1,2,3-Trichloropropane		A3
1,1,2-Trichloro-1,2,2-trifluoroethane	A4	
Triethylamine	A4	

Triothocresyl phosphate		A4
Triphenyl phosphate	A4	
Uranium, Soluble and insoluble compounds, as U	A1	
Vanadium pentoxide, Respirable dust or fume		A4
Vinyl acetate		A3
Vinyl bromide	A2	
Vinyl chloride		A1
4-Vinyl cyclohexene		A3
Vinyl cyclohexene dioxide		A3
Vinylidene chloride		(A3)
Vinyl toluene		A4
VM & P Naphtha		A3
Wood dust (Certain hard woods as beech & oak)	A1	
Xylene	A4	
Xylidine		A3
Zinc chromates, as Cr	A1	
Zirconium and compounds, as Zr		A4

1.1 *Appendix H*

Special procedures for Toxins and CDC/USDA Select Agent Toxins

a. General. In addition to the hygiene practices covered in the previous paragraphs, the following special procedures are to be used for laboratory operations involving toxins, including reproductive toxins. All toxins must be considered to pose a hazard in an aerosol form. Though most toxins exert their effects only after parenteral exposure or ingestion, and a few toxins present a dermal hazard. All CDC/USDA Select Agent toxin work must be done at Biosafety Level 2 or higher.

b. A complete list of CDC/USDA regulated Select Agent Toxins can be found at http://www.cdc.gov/od/sap/docs/salist.pdf

c. Storage and distribution

(1) Toxins will be kept in locked freezers and storage cabinets when not in use. Storage units will be labeled with the universal biohazard sign and indicate that toxins are being stored in the unit.

(2) When transporting, toxins will be double contained with the secondary containers labeled appropriately.

d. Engineering Controls

(1) Preparation of primary containers of toxin stock solutions and manipulations of primary containers of dry forms of toxins should be conducted in a chemical fume hood, a glove box, or a biological safety cabinet or equivalent containment system approved by the safety officer. HEPA and/or charcoal filtration of the exhaust air may be required, depending on the toxin.

(2) The user should verify inward airflow of the hood or biological safety cabinet before initiating work.

(3) All work should be done within the operationally effective zone of the hood or biological safety cabinet.

(4) When vacuum lines are used with systems containing toxins, they will be protected with a HEPA Filter to prevent entry of toxins in the lines.

e. Administrative and Work Practice Controls

(1) Two-person rule. ECBC policy states operators will use the 2-person rule for any work involving greater than 50% human lethal dose of toxin. Each must be familiar with the applicable procedures, maintain visual contact with the other, and be ready to assist in the event of an accident.

(2) When toxins are in use, the room should be posted to indicate "Toxins in Use-Authorized Personnel Only" along with a universal biohazard sign. Doors should be closed while any toxin operations are in progress. Any special entry requirements should be posted on the entrance(s) to the room. Only personnel whose presence is required should be permitted in the room while toxins are in use. Personnel who are not permitted under 42 CFR 73 are not allowed unescorted access to any room using CDC Select Toxins.

(3) When handling dry forms of toxins that are electrostatic do not wear gloves (such as latex) that help to generate static electricity. Use a glove bag with in a hood or BSC.

(4) When handling toxins that are percutaneous hazards gloves will be selected that are known to be impervious to the toxin and the diluent. Disposable laboratory clothing will be worn, left in the laboratory upon exit and disposed of as toxic waste.

f. Decontamination.

(1) Before containers are removed from the hood, cabinet, or glove box, the exterior of the closed primary container should be decontaminated and placed in a clean secondary container.

(2) Contaminated and potentially contaminated PPE and equipment should be decontaminated using methods known to be effective against the toxin before removal from the laboratory for disposal, cleaning or repair. If decontamination is not possible or practical, materials should be disposed of as toxic waste. Materials contaminated with infectious agents as well as toxins should also be autoclaved or otherwise rendered non-infectious before leaving the laboratory.

(3) The interior of the hood, glove box or cabinet should be decontaminated periodically, for example at the end of a series of related experiments. Until decontamination, the hood, box or cabinet should be posted to indicate that toxins are in use, and access to the equipment and apparatus restricted to necessary, authorized personnel.

APPENDIX I

RADIONUCLEIDS AT ECBC

Alpha:

Americium-241 (AM-241)

Beta – gamma:

Tritium (H-3)
Carbon-14 (C-14)
Phosphorous -- 32 (P-32)
Cobalt – 60 (Co-60)
Nickel – 63 (Ni-63)
Krypton – 85 (Kr-85)
Cesium – 137 (Cs-137)
Barium – 133 (Ba-133)

NOTE: None of the sources in Chemical Agent Detectors/Monitors are to be opened or removed from the source holders by ECBC personnel. Doing so could result in possible contamination and/or exposure to personnel. In addition, it is a Nuclear Regulatory Commission License violation, and could result in fines and possible license restrictions.

10.5 Appendix E: Sample Collection Guidance for Unknown Contamination Events

Sample Collection Guidance for Unknown Contamination Events

DRAFT

April 26, 2006

Sample Collection Guidance for Unknown Contamination Events

April 26, 2006
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Section 1.0
Scope and Application

This document is intended to provide guidance regarding the collection of environmental samples to be measured for biological or chemical contaminants in response to a contamination event or emergency. The *Sample Collection Guidance for Unknown Contamination Events* was developed to support the U.S. Environmental Protection Agency's (EPA) All Hazards Receipt Facility protocols designed to protect receiving laboratories from unknown hazards. The procedures in this document describe sample collection only, and assume that an initial site evaluation has been performed and the site has been cleared for radiological contamination or explosive devices. The samples collected using these procedures are assumed to contain unknown biological and/or chemical contaminants. Procedures that are included in analytical and collection methodologies should be consulted for the collection of samples that contain specific known contaminants.

The information contained in this document describes the following:

Section 2.0 – Safety and Personal Protective Equipment
Section 3.0 – Sample Collection Equipment
Section 4.0 – Documentation
Section 5.0 – General Guidance
Section 6.0 – Sample Collection Procedures
Section 7.0 – Sample Packaging and Shipment
Section 8.0 – References and Additional Resources
Appendix A – Example Forms

Section 2.0
Safety and Personal Protective Equipment

This section provides some general guidelines in the use of personal protective equipment (PPE) that are typically followed by Hazardous Materials (HazMat) Response Teams, and are recommended for sampling environmental material in response to an unusual or suspicious contamination event. This section also provides summary information regarding the types of hazards that should be considered. At a minimum, all sampling team members should be trained in Occupational Safety and Health Administration (OSHA) requirements for hazardous waste operations and emergency response at 29 CFR 1910.120 or 29 CFR 1926.65 and have current medical surveillance.

2.1 Personal Protective Equipment

Selection of protective clothing is dependent on known site conditions, response to unknown contamination and operations required. Specific guidance for selection of PPE is provided in Appendix B to 29 CFR 1910.120. Factors that should be considered during selection include: contaminant identification, routes of exposure (i.e., inhalation, skin absorption, ingestion, and injection), performance of equipment in protecting against exposure, activity duration, and stress induced by work requirements. Because the use of PPE can also cause hazards to workers (e.g., heat stress, impaired vision and mobility), care should be taken to provide a level of protection that is sufficient to prevent exposure yet is not too high so as to create other unnecessary hazards.

Most HazMat response teams are required to wear either Level A or Level B PPE when responding to an emergency call. Level A protection should be selected when the greatest level of skin, respiratory, and eye protection is required. It consists of a self contained breathing apparatus (SCBA) with a fully encapsulated chemical resistant suit under positive pressure. Level B protection is used for situations where complete protection against inhaled substances is needed, but a lesser level of skin protection than Level A is required. Small portions of skin are exposed to the atmosphere when in Level B, therefore, this level may be appropriate when the atmosphere does not pose any threat to the sampler via skin contact.

All PPE used should be inspected and certified for use at each site, via a qualified person. PPE levels should be modified in response to noted changes in field conditions, such as an increase in odor, unusual color changes in sampling matrix, and/or reaction monitoring of sampling team (e.g., dizziness, shortness of breath).

2.2 Health and Safety Plans

Health and Safety Plans (HASPs) will vary depending on the site, the response event, and the responsible organization. The purpose of these plans is to ensure maximum protection to workers, the environment, and surrounding communities, in a way that is consistent with requirements needed to perform operational activities. Different agency- or contractor-specific requirements will also dictate the required PPE level and will be indicated in the HASP.

The U.S. Army's cardinal principle to be observed in any location or operation involving explosives, ammunition, or toxic chemical or biological agents is to limit the potential exposure to a minimum number of personnel, for a minimum period of time, and to a minimum amount of the hazardous material consistent with safe and efficient operations.[1]

When collecting samples that potentially contain unknown chemical or biological hazards, responders should follow the HASP that is specific to their organization or to the event. Health and Safety Plans should include, at a minimum, instructions and guidelines regarding:

- Names, positions, and contact information of key personnel and Health and Safety personnel
- Site or event-specific risk analysis
- Training requirements for specific events
- Personal protective equipment onsite and usage requirements
- Medical surveillance requirements (maintain confidential documents properly and securely)
- Site or event control
- Emergency response plan, containing offsite Emergency Contact information such as local HazMat teams or additional trained rescue personnel (29 CFR 1910.38)
- Entry procedures
- Spill containment
- Decontamination procedures

In the case of emergency response, these plans also should ensure protection of potential evidence, criminal or forensic (see discussion in Section 5.2).

2.3 Personal Safety Considerations

The following general guidelines should be considered and followed by first responders and sample collectors following an event that may involve chemical or biological agents. This guidance is general, and site-specific procedures should be followed on a case-by-case basis.

- Stop and assess the situation.
- Contact the appropriate trained personnel.
- Remove all non-essential personnel from exposure, but do not allow them to leave the site.
- Wear appropriate PPE.
- Approach the site upwind of the suspected source or contamination area.
- Handle contaminated materials with minimum manipulation.
- Maintain decontamination and contamination free zones properly.
- Contain all contaminated PPE and sampling equipment for disposal or decontamination.

2.4 Hazard Exposure

The following text describes some of the potential hazards that may be encountered by personnel when collecting samples in emergency response scenarios. This information is excerpted from *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, prepared by: National Institute for Occupational Safety and Health (NIOSH), OSHA, U.S. Coast Guard, U.S. EPA, October 1985.

[1] U.S. Department of the Army, Pamphlet 385-61, *Toxic Chemical Agent Safety Standards*, 27 March 2002.

Information regarding the properties and effects of exposure to chemical and biological agents are presented in Tables 2-1 and 2-2. The information in these tables is taken from the Laboratory Safety Supply Inc. *Domestic Preparedness and Response a Guide for First Responders*, Spring 2005 Catalog.

If people were exposed to the unknown substance, and no symptoms occurred within 30 minutes, then lethal quantities of chemical agent are probably not present. Tables 2-1 and 2-2 should be consulted if symptoms are present. For many biological agents, symptoms do not occur for days, others within a few hours. Potentially exposed persons should not be allowed to leave the site without a known documented address, documentation of exposure, exposure symptoms and, if necessary, medical monitoring or treatment.

2.4.1 Explosion and Fire

Although explosions and fires may arise spontaneously, usually they result from site activities, such as moving drums, accidentally mixing incompatible chemicals, or introducing an ignition source (such as a spark from equipment) into an explosive or flammable environment. Explosions and fires not only pose the obvious hazards of intense heat, open flame, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals. Keep all potential ignition sources away from an explosive or flammable environment; use non-sparking, explosion-proof equipment; and follow safe practices when performing any task that might result in the agitation or release of chemicals.

2.4.2 Chemical Exposure

An important exposure route of concern at a hazardous waste site is inhalation. Even substances that do not directly effect the lungs may pass through the lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Respiratory protection is extremely important if there is a possibility that the work site may contain such hazardous substances.

Direct contact of the skin and eyes by hazardous substances is another route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

2.4.3 Biological Hazards

Biological contaminants are generally undetectable by human senses, and symptoms may not appear for days or weeks following exposure. Like chemical hazards, etiologic agents may be dispersed in the environment via water and wind. Protective clothing and respiratory equipment reduce the chances of exposure. Thorough washing of any exposed body parts and equipment

will help protect against infection. The effects of exposure to biological hazards may be mitigated by use of antibiotics (e.g., anthrax exposure), vaccines (e.g., smallpox exposure), or antitoxins (e.g., botulism).

2.4.4 Properties and Effects of Chemical and Biological Agents

Chemical and biological agents are toxic substances, pathogens, or toxins that are intended for use to kill or incapacitate people, animals, or plants. There are four general categories of chemical agents (choking agents, blood agents, blister agents, and nerve agents) and five general categories of biological agents (pathogens, bacteria, viruses, fungi, and toxins). All of these agents vary in their toxicity, mode of action, and effect. Tables 2-1 and 2-2 provide information regarding the properties of some of these agents and their effects in terms of human exposure.

Table 2-1: Chemical Agent Properties and Effects

Note: This table was taken from the Laboratory Safety Supply Inc. "Domestic Preparedness and Response a Guide for First Responders," Spring 2005 Catalog.

Chemical Agent Name	Agent Type	Physical Properties	Physiological Effects	Time to Effect
Chlorine	Choking	Pungent odor, greenish-yellow heavier than air gas	Corrosive to eyes, skin and respiratory tract. Burning sensation followed by coughing, headache, labored breathing and nausea. Pulmonary edema	Immediate irritation in high concentrations. Symptoms of lung edema may take several hours to appear
Hydrogen Cyanide	Blood	Almond odor, highly volatile gas	If high concentration, violent convulsions after 20-30 seconds, breathing stops in one minute; cardiac failure occurs within a few minutes	Very rapid; incapacitation within minutes and death within 15 minutes
Lewisite	Blister	Colorless, oily liquid with little odor in its pure state. Amber to geranium-like odor with amber to dark-brown color in less pure form	Stinging pain followed by blistering. It is also a systemic poison causing pulmonary edema, diarrhea, hypotension and restlessness	Initial pain in 10-20 seconds; blistering within 12 hours
Mustard	Blister	Possible garlic odor, medium volatility, oily liquid	Blisters or irritation to skin, eyes and lungs	Delayed onset (4-6 hours)
Phosgene	Choking	Fresh cut hay odor, heavy gas	Coughing and choking, followed by chest tightness, nausea, tearing, vomiting and headaches. Death due to fluid accumulation in the lungs	Immediate irritation in high concentrations, and delayed reaction (several hours) in low concentrations
Sarin	Nerve	Colorless/odorless, volatile liquid	Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions, and eventually death	Rapid (within minutes)
Tabun	Nerve	Clear, odorless, tasteless liquid with (may have a slight fruity odor)	Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions and eventually death	Rapid (within minutes)
VX	Nerve	Colorless/odorless, low volatility, oily liquid	Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions and eventually death	Relatively rapid (within 30 minutes)

Table 2-2: Biological Agents and Effects

Note: This table was taken from the Laboratory Safety Supply Inc. "Domestic Preparedness and Response a Guide for First Responders," Spring 2005 Catalog.

Disease (common name)	Biological Agent name	Agent Type	Physiological Effects	Time to Effect
Anthrax	*Bacillus anthracis*	Bacteria	Mild fever and fatigue, worsening to severe respiratory disorders, high fever and excessively rapid pulse rate. Death can occur within 5-12 days of exposure if left untreated. Pulmonary anthrax is fatal more than 90% of the time.	1-5 days
Botulinum Toxin	Clostridium botulinum	Biotoxin	Initial symptoms include extreme weakness, nausea, headaches and intestinal pain leading to respiratory paralysis that may cause death.	2-36 hours
Plague	*Yersinia pestis*	Bacteria	Fever, headache and rapid heart rate, followed by pneumonia and hemorrhaging of the skin and mucous membranes. Untreated plague pneumonia fatalities approach 100%, but early treatment can reduce mortality to as low as 5%.	2-3 days
Ricin	*Ricinus communis* (castor bean plant)	Biotoxin	Initial symptoms include high fever, pain, cough and shortness of breath; after several days severe dehydration and a decrease in urine/blood pressure. If death has not occurred in 3-5 days, the victim usually recovers.	Several hours
Smallpox	Variola major	Virus	Sudden onset of fever, malaise, headache, severe backache and prostration; after 2-4 days fever falls and rash appears; scabs form and fall off at the end of the fourth week.	10-14 days
Tularemia	*Francisella tularensis*	Bacteria	Symptoms include fever, chills, headache, and muscular pain. 30-60% mortality rate if left untreated; treated, the mortality rate is reduced to 1%.	3-5 days

Section 3.0
Sample Collection Equipment

It is highly recommended that sampling kits be used during sample collection, and that these kits be properly equipped, maintained and organized before responding to an event. This will allow the sampling team to enter and exit the suspected contaminant area in the shortest and most effective amount of time. Sample kits should contain all sample containers, materials, supplies, and forms needed to perform sample collection, decontamination, documentation, and field packaging activities. Packaging for sample shipment to the laboratory should be conducted in a specified controlled location near the clean zone so that sample documentation can be checked for accuracy and each sample container can be properly protected from breakage.

Sampling equipment should be organized into a portable kit prior to initiating any sample collection activity. Each kit should be maintained to ensure that chemical preservatives have not expired, that equipment has not dried out (e.g., pre-wetted swabs or wipes), and that certified clean or sterile containers have not been breached. Each equipment kit should contain extra blank labels, pens, markers, and sampling forms to ensure proper recording of sampling information. Safety gloves, paper towels, and plastic bags should also be in abundance.

Often the sampling team can determine whether the threat is chemical or biological and the class of contaminant from the initial incident report. The ability to reduce the number of sampling containers to reflect the expected contamination will assist not only in reducing the amount of sample that should be collected, but also in reducing time and potential exposure. If the contaminants are unknown and limited sample quantity is available, samplers should collect one sample into each container type, and repeat until there is no more sample available or all of the containers have been filled. Table 3-1 lists the specific equipment and containers needed for the collection of solid, wipe, non-aqueous liquid, and aqueous samples. Laboratories should be able to supply the containers necessary for sample collection and can often include the preservatives within the sample containers.

If the sample containers contain preservatives, the sampling team is responsible for ensuring that proper preservation requirements are met. Additional preservatives should be on site to properly adjust the sampled material in case of buffering or other interferences. Caution should be observed when adding sample material to a preservative or when adding a preservative to a sample.

Table 3-1: Sample Collection Equipment

Sampling Kits		Equipment
Chemical Hazards	Biological Hazards	
Solid samples		
• Two 4 oz or larger certified clean glass container with a Teflon® lined lid • Outer plastic container • Absorbent material for packing between glass and plastic containers • Certified clean scoop, spoon, spatula, or scalpel • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label	• Sterile plastic container with a Teflon® lined lid (50 mL centrifuge tubes) • Sterile scoop, spoon, spatula, or scalpel • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label • Pipettes • Outer plastic container or bag	• Disposable nitrile gloves • Sealable bags, thick trash bags • Sturdy shipping container • Sample labels, chain of custody forms, field notebook, permanent marker, all weather pens • Ruler or tape measure • Camera
Wipe and swab samples		
• Certified clean cotton swab or wipe • Outer plastic container • Absorbent material for packing between glass and plastic containers • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label	• Sterile non-cotton swab or wipe • Sterile plastic container with a Teflon® lined lid • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label • 8" Hemostats • Outer plastic container or bag	• Liquids for moistening the wipes or swabs: sterile/decontaminated water or phosphate buffering solution • Disposable nitrile gloves • Sealable bags, thick trash bags • Sturdy shipping container • Sample labels, chain of custody forms, field notebook, permanent marker, all weather pens • Ruler or tape measure • Camera
Non-aqueous liquid samples with syringe		
• Certified clean sample syringe and blunt tip needle • 4 oz or larger certified clean glass container with a Teflon® lined lid • Outer plastic container • Absorbent material for packing between glass and plastic containers • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label	• Sterile sample syringe and blunt tip needle • Sterile plastic container with a Teflon® lined lid • Sealable transparent bags • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label • Pipettes • Outer plastic container or bag	• Certified clean Teflon® tubing to fit syringe needles • Tubing weights • Disposable nitrile gloves • Sealable bags, thick trash bags • Sturdy shipping container • Sample labels, chain of custody forms, field notebook, permanent marker, all weather pens • Ruler or tape measure • Camera

Sampling Kits		Equipment
Chemical Hazards	Biological Hazards	
Non-aqueous liquid samples with glass tube		
• Certified clean sample tube • 4 oz or larger certified clean glass container with a Teflon® lined lid • Outer plastic container • Absorbent material for packing between glass and plastic containers • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label	• Sterile sample tube • Sterile plastic container with a Teflon® lined lid • Sealable transparent bags • Individually wrapped disposable bleach wipes • Parafilm™ wax paper • Custody seal and sample label • Pipettes • Outer plastic container or bag	• Disposable nitrile gloves • Sealable bags, thick trash bags • Sturdy shipping container • Sample labels, chain of custody forms, field notebook, permanent marker, all weather pens • Extra containers for discarding the liquid near the phase boundaries • Ruler or tape measure • Camera
Aqueous samples		
• Decontaminated sampling implement (if necessary) • Pipettes • See Table 3-2 or 3-3 for containers • Custody seal and sample label • Parafilm™ wax paper • Absorbent material for packing between glass and plastic containers • Outer plastic container	• Sterilized sampling implement (if necessary) • Pipettes • See Table 3-2 or 3-3 for containers • Sealable transparent bags • Individually wrapped disposable bleach wipes • Custody seal and sample label • Parafilm™ wax paper • Outer plastic container or bag	• Disposable nitrile gloves • Sealable bags, thick trash bags • Sturdy shipping container • Sample labels, chain of custody forms, field notebook, permanent marker, all weather pens • Ruler or tape measure • Camera • pH paper • Preservation chemicals

Table 3-2 provides a recommended set of containers and preservatives that can be used for aqueous samples when dealing with a suspected contaminant or contaminant class. If the sample collectors are responding to an incident in a potential drinking water source or utility and the contaminant is unknown, it is recommended that all of the containers listed in Tables 3-2 and 3-3 be used for sample collection. Sampling teams may not have this variety of containers and preservatives on hand at short notice. If this is the case, sample collectors should try to follow Table 3-2 as closely as possible, taking several extra non-preserved containers to allow the laboratory to confirm analysis. If the contaminant or contaminant class is known, a subset of the containers and preservatives listed in Tables 3-2 and 3-3 can be used.

Table 3-2: Containers for Drinking Water Samples

Sample Type	Container Size	Container Type	No. of Containers
Volatiles	40 mL	Glass with Teflon®-lined septa	5
Semi-volatiles	1 L	Amber with Teflon®-lined screw caps	4
Quarternary nitrogen compounds	1 L	Amber PVC or silanized glass	4
Carbamate Pesticides	40 mL	Glass with Teflon®-lined septa	4
Metals	125 mL	Plastic (i.e., HDPE)	2
Organometallic compounds	125 mL	Plastic (i.e., HDPE)	2
Cyanide	1 L	Plastic	2
Unknown organics (volatile)	40 mL	Glass with Teflon®-lined septa	5
Unknown organics (general)	1 L	Amber Glass	4
Unknown inorganics	1 L	Plastic	2
Biotoxins	1 L	Amber Glass	2
Water quality: Chemistry	1 L	Plastic	1
Dilute Biologicals	100 L	Plastic	5 (20-L Carboys)
Water quality: Bacteria	250 mL	Plastic	1

Table 3-3: Expanded List of Containers for Sampling Aqueous Media

Contaminant Type	Containers		Preservation
	Chemical	Biological	
Volatiles	(5) 40-ml Glass with Teflon®-lined septa		HCl to pH < 2
Carbamate Pesticides	(4) 40-ml Glass with Teflon®-lined septa		Potassium dihydrogen citrate sample pH to ~ 3.8
Unknown organics (general)	(4) 1-L Amber glass with Teflon®-lined screw caps		None
Metals/Elements	(2) 1-L Plastic	-	Nitric acid to pH $\leq$ 2
Cyanide	(2) 1-L Plastic	-	Sodium hydroxide to pH 12
Unknown inorganics	(2) 1-L Plastic	-	None
Pathogens - culture*	-	(2) 100-ml HDPE	If chlorinated, sodium thiosulfate
Pathogens - PCR*	-	(2) 100-ml HDPE	If chlorinated, sodium thiosulfate
Water quality: Bacteria	-	(1) 250-ml Plastic	If chlorinated, sodium thiosulfate

*It is extremely difficult to detect biological agents in drinking water unless they are very concentrated.
If there is a lot of water present, five 20-L carboys are the preferred containers for collection of biological agents in an aqueous matrix.

Section 4.0
Documentation

Thorough documentation of sample collection activities and identification is needed to ensure the validity of samples and corresponding analytical results. This documentation is used to ensure that samples are representative, protected from tampering, have been collected in accordance with collection requirements and have not been exposed to compromising conditions. At a minimum, sample collection documentation should include:

- Sample identification numbers
- Sample collection label attached to all sample containers
- Records of sample collection operations
- Chain of custody (COC) form
- Custody seals

Waterproof black indelible ink must be used for the labels, COC forms and custody seals. If a mistake is made while completing each form, do not erase. Draw a line through the error, add the correct information and initial and date the form where the mistake occurred. This is required for legal documentation and should be followed on all sampling documents.

4.1 Sample Identification Numbers

Each sample consists of all the material collected from a given location at one time, and of one matrix. A sample identification number that is unique for each sample is created by the sample collector, the receiving laboratory, and/or a program or project manager. Sample identification numbers often consist of elements describing the sample type, matrix, location, and time and date of collection. This number is unique to each sample and is placed on all sample documentation. The number is used to identify the sample on field reports, log books, chain of custody records, and sample containers and labels. The number also can be used on corresponding analytical data reports or evaluations.

4.2 Sample Container Labels

Each sample container must have a label that clearly provides information identifying and describing the sample. At a minimum, sample container labels should provide the following information:

- sample identification number
- name of the sample collector(s)
- type of sample (grab or composite)
- date and time the sample was collected
- sample matrix (water, liquid, solid, powder, etc.)
- site location (e.g., site name or address)
- preservatives added (if applicable)
- indication of known or suspected hazards

All of the information on the sample label must be identical to the information on the COC form and any other required sample forms. The sample collector should be able to retrieve the documents and determine where and when the samples were taken in case additional sampling or analysis is necessary.

To facilitate sample collection activities and ensure proper labeling, sample containers should be pre-labeled, as much as is practical, prior to sample collection. Sample labels should be completed using waterproof ink and securely affixed to each sample container. If a waterproof pen is not used, it is recommended that the label be covered with clear packaging tape to protect the information provided.

An example sample label is provided in Figure 4-1.

Figure 4-1
Example Sample Container Label

Project/Event: _____
Sample Number:_____
Container Number: _____
Date: _____ Time: _____
Location: _____
Container Size: _____
Container Type: _____
Matrix: _____
Sample Type: (e.g., grab, composite)
Preservation, if applicable:_____
Sample Collector(s):_____
Signature: _____

4.3 Field Report Forms

Field reporting forms are used to alert the receiving All Hazards Receipt (AHR) Facility or laboratory of any known or suspected hazards. These forms should prominently show the Sample ID(s) that are relevant to the field report, the location of sample collection, sample collector name(s) and date/time of collection are also helpful for verification. These reports also should contain a description of the sample and any information the samplers witnessed or know about the sample, including:

- Date and time of sample collection
- Weather conditions
- Level of PPE used
- Name and signatures of sample collectors and others present during collection
- Symptoms of those exposed to the sample
- Number of people exposed
- Approximate quantity of material present including units
- General conditions of exposed flora and fauna if available
- Agencies involved in the sampling effort
- Contact information of samplers or agency coordinators or managers
- Field screening methods, instruments used and their results

The information contained in the field reports can be used to help the laboratory or AHR Facility determine an appropriate screening or analytical strategy. If certain types of sample screening have been performed in the field, laboratory pre-screening may not be necessary and the results may expedite sample analysis in the laboratory. Information regarding any symptoms or environmental effects caused by the contamination also will greatly aid sample recipients in regards to sample handling precautions and

the level of PPE needed. Examples of a Sample Report Form and a Field Testing Report Form are provided in Appendix A, Figures A-1 and A-2 respectively.

4.4 Photographs

Photographs are important field documentation at any site, especially where there are forensic concerns. All site photography should begin with a wide overall view and then progress to more detailed photos. Entry and exit photos should always be included. Always try to provide wide angle, medium, and close up photographs of the relevant areas of the site. Whenever possible include a device to measure scale in the photographs. This is best done with a ruler or tape measure displayed visibly in the photograph. Photograph logs must be maintained during the sampling event. An example of a photograph log is provided in Appendix A, Figure A-3.

4.5 Chain of Custody Forms

A Chain of Custody (COC) form creates an accurate written record that can be used to trace the creation, possession, and handling of the sample from the moment of its collection through analysis. Chain of Custody is used and required, without exception, for the tracking and recording of on-site and off-site sample collection, transport and analysis. An example COC form is provided in Appendix A, Figure A-4.

A COC form accompanies each sample or group of samples as custody of the sample(s) is transferred from one custodian to another. One copy of the form is retained by the original sample collector and the original is obtained by the receiving laboratory. If multiple laboratories are receiving a sample, individual COCs should be submitted to each individual laboratory, each COC representing the contents of the sample shipment. A representative of each laboratory or facility accepting an incoming sample shipment signs and dates the COC record. It is the laboratory or facility's responsibility to maintain internal logbooks and custody records throughout sample preparation, analysis and final disposal. Sample custodians are responsible for initiating, maintaining, and completing COC tracking. A sample custodian is the person responsible for the custody of a sample or samples at a particular time, until custody is transferred to another person (and so documented), who then becomes the new custodian. A sample is under a person's custody if:

- it is in that person's possession,
- it is in that person's view, after being in that person's physical possession,
- it was in that person's physical possession and then he/she locked it up to prevent tampering, or
- it was in that person's physical possession and then he/she placed it in a designated and identified secure area.

Note: Common commercial carriers usually will not accept responsibility for handling COC forms. This often necessitates packing the COC record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping or transport container and the custody seals are intact, commercial carriers are not required to sign the custody form. Utilizing a computer and the Web, the tracking information generated by a common carrier can be obtained if complete custody tracking is required. This documentation is attached to show the sample container was in the possession of the carrier during the missing COC custody time. This time period should be noted as "common carrier" on the COC between the final custodian at the sample site location and laboratory receipt.

Although COC forms vary in style, format, and detail the forms should contain the same minimal information required to identify the sample. Procedures for filling out other styles of COC forms will be very similar. It is best for the samplers to fill out the COC provided by the party receiving the samples. The COC form in Figure A-4 assumes that the samplers do not know what analyses to request for the sample, and that this will be decided after the sample is screened. The following information should be provided and steps followed to complete COC forms:

- General incident information (sample owners, contact information, site name)

- Sample specific information for each sample that will be traveling in the same cooler/transport container [i.e., sample identification number, sample type (matrix), grab or composite, number and type of sample containers, and date/time sample was collected]

- Sign, date, and enter the time under "Relinquished by" entry. Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (e.g., Federal Express, UPS).

- If a common carrier is used, enter the air bill number under "Remarks," in the top right corner.

- Place the original signed copy of the COC form in a plastic zipper-type bag or other appropriate waterproof sample shipping package. Retain a copy with the field records.

- Complete custody seals (See Section 4.6) and other carrier-required shipping papers.

- If possible, fax or scan and email a copy of the COC and field report to the party receiving the samples.

4.6 Custody Seals

Custody seals are attached over the cap of each sample container to assure the sample has not been opened or tampered with after collection and packaging. Alternatively, the shipping or transport container is also sealed by placing a custody seal over the closed opening making it impossible to open the container without ripping the seal. Typically there is one seal per sample container and two seals placed on opposite sides of the shipping container. Custody seals contain the signature of the person responsible for packing the container and the date sealed. The seal must be sturdy to resist incidental contact but able to break when the cap or lid is moved. Sample collectors should:

- Sign and date sample custody seal, usually a 1- by 3-inch white paper label with black lettering and an adhesive backing. The custody seal is part of the COC process and is used to prevent or identify tampering with samples.

- Place the custody seal across container openings so that it would be broken if a container were to be opened. This often requires multiple seals covering any opening. If a cooler is utilized, ensure that the water drainage point is secure.

Section 5.0
General Guidance

5.1 Sampling Plan

Once an event has occurred, a site evaluation should be performed to ensure the safety of sampling personnel; determine the number, type, and location of samples to be collected; and identify, as much as possible, the type and extent of contamination. The procedures presented in this document assume that a sampling plan has been developed based on a site evaluation.

In some cases, the extent and type of contamination are readily apparent and can be determined by visual inspection (e.g., the contamination results in environmental effects or in chemical or biological hazardous characteristics). Some types of contamination also can be determined if any field measurements have been taken. This information can be collected from the site evaluation, first responder reports, or from observations at the site, and can be used to determine which containers and equipment should be used for sample collection (e.g., if combustible gas indicators or photoionization detectors used in the field indicate the presence of volatile organic compounds, samples should be collected in glass containers with no headspace). If insufficient information is available to determine the type of contamination, and sufficient sample is available, samples should be collected into each type of container listed in Tables 3-1 through 3-3 or included in the sampling equipment available to the sample collectors. In general, samples containing hazardous chemicals (including CWAs or corrosive materials) should be collected in certified clean glass containers with Teflon® (i.e., polytetrafluoroethylene, PTFE)-lined lids. Samples to be measured for biological contaminants must be collected into sterile containers.

5.2 Forensic Protection and Interagency Cooperation

When collecting samples following a contamination event, sampling activities must be conducted with the cooperation of any and all agencies investigating the incident. Such cooperation will help ensure that the necessary steps are taken to preserve a potential crime scene and that proper evidence is collected. Special care should be taken to avoid moving any evidence until adequate documentation is conducted and the appropriate officials are notified. The following general protocols for maintaining crime scene integrity are provided as guidance only, and should not be considered to be exhaustive. The agency or agencies responsible for site investigation should be consulted for information regarding evidence requirements.

- Collection of environmental samples is time sensitive due to the public health and sample preservation implications. Thus, collection of samples may precede collection of physical evidence, and care must be taken not to disturb the crime scene while performing these activities.

- Physical evidence should be collected in cooperation with the appropriate law enforcement agency. Specially trained teams from the law enforcement community are best suited (and may be jurisdictionally required) for the collection of physical evidence from a contaminated crime scene.

- Samples collected during a criminal investigation will be monitored by the local, State, or Federal authorities and might be confiscated. Documentation of all actions taken within a criminal investigation is required. Copies of all documentation should be maintained by all agencies present.

- Special care should be taken to avoid moving or disturbing any potential physical evidence or spreading the contaminant. Substantial physical evidence of a contamination event might include discarded PPE, equipment (such as pumps and hoses), and containers with residual material.

- Samples may be considered evidence, and thus could be subject to security measures. These measures may include keeping samples under the control of designated personnel at all times. When these samples are not in the possession of designated personnel, the samples should be secured (e.g., locked in a secure area) and accessible only by designated personnel. In the field, samples may need to be locked in a vehicle.

- It may be necessary to collect duplicate samples for law enforcement and to take photographs of the samples at the site of collection as an additional form of sample documentation.

- The samplers should, when possible, take pictures of the sample location and the sample container(s) at the location where the sample was collected. Law enforcement should be consulted for proper handling during and after taking photographs/videos to ensure integrity of the evidence. Information concerning the times and locations of photographs taken or video recorded should be noted in a site logbook. A chain of custody form should be maintained for all film development in order to ensure proper handling and tracking. *Note:* Photographs or video taken in areas of high security, as well as notations and information collected regarding the area, may need to be discussed with the law enforcing agency prior to entry. Videos and pictures may not be possible in areas of high security; as a result, drawings and written descriptions may become critical documentation.

- Sample chain of custody (COC) documentation should be initiated immediately after sample collection.

- Since analytical results may be considered to be evidence, it is important to use a qualified laboratory for analytical support and to gain written authorization to release documentation.

- Before exiting the site samplers should, at a minimum, practice the following:

  - Verify that the perimeter has been properly secured before leaving the site. Verify that hatches, locks, etc. are properly secured.
  - Remove all samples, equipment, and materials from the site. Remove all PPE at site perimeter and place disposable PPE and other trash into a heavy-duty plastic trash bag.
  - Verify that all samples are in a transport container and properly seal the container.
  - Ensure that all documentation has been completed.
  - Comply with any other site control measures required by participating agencies.

5.3 Sample Representativeness

In most cases, sample collection will target the source of contamination. The source may be obvious (e.g., a scattered powder, visible splatters, a puddle or container of liquid that has caused physical symptoms to those around it) or not obvious (e.g., non visible biological contamination).

The following general guidance is provided for collection of samples that result in valid and representative data that can be used in decision making:

- If more than one color of powder is present, collect at least two samples, one with each color of powder. If the powders are mixed together, try to collect one sample that contains mostly one color of the powder, and another that mostly contains the other color.

- When very limited quantities of liquid sample are present, check nearby areas to see if the liquid has absorbed into any porous or absorbent materials. Cloth, paper, or cardboard that has been soaked with a liquid can be removed with scissors or a scalpel, and then placed into a sample container. Soaked material can often yield a functional sample.

- Some explosive compounds or chemical agents are produced when two materials are mixed together. If there appears to be a container within a container (e.g., a torn plastic bag inside a bucket) collect samples from both the inner and outer container. *Note*: If the inner container has not been compromised - DO NOT DISTURB IT!

- Some materials may evaporate or disperse quickly. If visible contamination was reported in an area, but appears to have evaporated or dispersed, take several wipe or swab samples of the area. There still may be residue or residual concentrations present that are not visible to the naked eye. For powders that may have dispersed, it also would be a good idea to take wipe or swab samples from nearby vent openings. Small powder particles may accumulate where volumes of air are forced through small areas. Evaporation cannot be controlled in most cases. Air monitoring may be the only mechanism to gathering additional data.

- When sampling a liquid from a container, make sure that there are not multiple layers of different liquids. If multiple layers are present, take a sample from each layer (see Section 6.2.3).

5.4 "Hot Zone" or "Hot Line" Sampling

Sometimes a "Hot Zone" is set up around an area that is believed to have elevated levels of contamination. The border between the hot zone and uncontaminated or less contaminated zones is designated the "Hot Line." This line can be used to restrict entry to the contamination area and to set areas for elevated PPE requirements. Persons entering a Hot Zone should be fully qualified for collection of samples from hazardous areas, including the appropriate current U.S. Occupation Safety and Health Association (OSHA) training and certification. Usually all materials that enter a Hot Zone have to either undergo decontamination or field screening before exiting the zone. This includes, but is not limited to, all personnel, PPE, sampling tools and any other equipment/materials. Thus, it is beneficial to leave as much equipment as possible outside of the Hot Zone (i.e., take only the minimum amount of equipment needed to collect representative samples into the Hot Zone).

In an ideal scenario, one sampler enters the Hot Zone carrying the minimum amount of equipment needed to take the sample. A second sampler or technician remains just on the other side of the Hot Line with the remaining sampling equipment to support the primary sampler. This approach is only practical if the Hot Zone is small enough to allow the two samplers to observe and easily aid each other. A third person should be available to assist the sampling team in the event additional materials are required. This third person should NOT enter the Hot Zone.

A second zone should be set up at one designated location, just outside the Hot Zone, to restrict entry and collect potentially contaminated materials. This zone is a Decontamination Zone. All persons who enter the Hot Zone would be required to exit the Hot Zone into the Decontamination Zone, removing all PPE

and washing all equipment prior to entering the clean zone. The area also provides a known staging area and emergency wash area.

5.5 General Guidance

The following general guidelines should be considered and followed prior to sample collection:

- It is recommended that at least two personnel are involved in sample collection. The primary sampler has control of the sampling activity and is responsible for physical sample collection, filling the containers, and cleaning the outside of the containers. The second sample collector or technician is responsible for labeling, packaging, record keeping and communication with the outside zones. If site geography or the contamination warrants, a third person with the sole task of record keeping should accompany the sampling team. This third party will carry any cameras and will stay in frequent radio communication with others outside of the Hot Zone.

- Review any available information regarding the site or contamination event to determine if any additional equipment or PPE is needed. It is better to be prepared than to risk exposure to the sampling team.

- Note the full extent of the contamination area and if the contamination is general or concentrated in areas. If possible, note the migration or potential routes of the contamination.

- Assemble more sampling kits than are expected to be needed. Sampling kits are composed of a sealable bag with the required container(s), documentation forms, storage and transport containers, decontamination materials, and sample collection equipment.

- Complete the sample container labels as much as possible prior to sample collection. A label should be attached to every container and outermost containment bag/container to assist in easy collection. This pre-sampling organization is significantly easier and less time consuming to do while in the comfort of an office, staging location, or vehicle than while sampling in personal protective equipment in the field.

- At a minimum, wear safety glasses and two pairs (layers) of nitrile gloves over regular safety equipment. Only the outer gloves need to be changed between each sample as long as the inner gloves remain clear of all contamination. Proper safety practices should always be observed. Potable water should be carried to remove contaminated materials from skin or eyes.

- Leave the sampling kits at the perimeter of the Hot Zone, on the clean side of the Hot Line, preferably in the decontamination area. Sample containers should be treated as requiring custody to eliminate the potential for inadvertent or criminal external contamination, and should not be left unsupervised.

- Radio contact should be maintained with someone outside of the Hot Zone. This contact provides safety and can assist in identifying the hazard(s) by relaying information to additional members of the assessment team.

- A sampler or technician should be available to record a log of everything the sampling team does, note the time and record other details that might assist in interpreting the analytical data generated by the laboratory or screening facility. Take at least one picture of the area at the entry to the Hot Zone

and several pictures of the impacted area. Take pictures of the areas to be sampled. If possible, lay a ruler or tape measure by the sampling points to allow the viewers of the pictures to know the scale of the photograph.

- Leave the sampling site undisturbed and return to the decontamination area to gather supplies and/or additional personnel.

Section 6.0
Sample Collection Procedures

The following sample collection procedures are intended to serve as guidelines for sampling environmental media following an unusual or suspicious contamination event, and should be modified as needed to fit the specific event. The procedures assume all samples will be grab samples (media collected at one time from one location), and that no sample homogenization will be performed in the field. The sampling protocols focus only on sample collection and do not include field screening methods. It is important to note, however, that certain aspects of sample collection (e.g., number and type of samples collected) may be dependent on the results of field screening and site assessment. The sampling protocol guidelines are for collecting samples that are assumed to contain high concentrations of unknown hazardous materials, for this reason, smaller quantities of sample may be acceptable when compared with standard environmental sampling requirements.

In some cases evidence from the site, emergency response reports, or results from field screening may provide some indication of the type of contamination or if target contaminants are chemical or biological. If the contamination is completely unknown, then it is necessary to provide the analytical laboratory with a complete set of containers appropriate for both chemical and biological analysis, provided a sufficient amount of sample is available.

> *Note*: All equipment and containers used for collection of samples to be analyzed for biological contaminants must be certified or known to be sterile. Equipment and containers used for collection of samples to be analyzed for chemical contaminants must be certified or known to be free of potential contaminants.

6.1 Collection of Bulk Solid Samples

This scenario includes collection of unknown powders, granular materials, pellets, paint scrapings, and potentially contaminated soils. Visible and accessible quantities of suspected contaminants can be collected by placing the material directly into a sterile sample vial or container of appropriate size using a clean sample spoon, trowel, or spatula. If the material is dispersed or not enough material is present to collect directly, samples should be collected using wipes or swabs. If the contamination appears to be composed of more than a single material, multiple samples should be collected to target each material. If collection of multiple materials is not feasible, the sample(s) collected should contain all materials suspected to contain the contaminant or contaminants. A description of the materials collected should be recorded on the field report form.

6.1.1 Equipment needed

The following equipment is needed to collect bulk solid or wipe samples. If biological samples are to be collected, the equipment used, including gloves, must be sterile.

- Clean, disposable nitrile gloves (at least two pair per individual)
- Containers for suspected chemical contaminants – certified clean, four ounce or larger glass container with a Teflon-lined top
- Containers for suspected biological contaminants – sterile plastic container (e.g., 50-mL centrifuge tubes)
- Plastic outer container, large enough to hold glass containers used to collect samples for chemical compounds (typically 8 or 16 ounce wide mouth container is sufficient)
- Non-cotton (foam, polyester, or rayon) swabs for small or porous surfaces
- Sterile 3"× 3" synthetic wipes (non-cotton for biologicals) e.g., gauze pads, Handi-Wipe®, sterile sponges – used to collect samples from large (~100 cm^2), accessible, non-porous surfaces
- Clean spoon, spatula, trowel, or scoop
- Quart-sized self-sealing plastic bags
- Sealing tape or Parafilm™
- Transport container – large plastic container (e.g., cooler) capable of holding primary sample container(s) and packing materials, including ice
- Absorbent material for packing (e.g., antiseptic bandage pads or non-cotton cloth)
- Individually wrapped disposable bleach wipes
- Potable water – for immediate removal of contaminated materials from skin, eyes, or other surfaces
- Sterile water, saline, or phosphate-buffered saline (PBS)

6.1.2 Sample collection using spoon or scoop

- Put on clean, sterile, powder-free latex, nitrile, or vinyl examination gloves and other required PPE prior to sampling.

- If the sampling team is unsure as to whether the substance is a chemical or biological hazard, samples should be collected into at least two containers, one sterile container and one certified clean container. If a sufficient amount of sample is available, each container should be filled using a clean scoop or spoon. If only a small amount of sample is present, containers can be filled using a spatula.

- If the sample is composed of corroded plaster or paint that appears to have been impacted by chemical contact, a scalpel or stainless steel spoon should be used to scrape the material into the container. Sometimes a saturated piece of clothing, carpet or cardboard is encountered. In these cases, samplers may want to cut the material into small pieces that will fit into the sample container.

- Carefully fill containers to within ¼-inch from the top. If the sample has a limited quantity, containers should be filled as much as possible. *Note*: If the substance collected is known to be a reasonably pure hazardous biological or chemical substance, a few grams of material should be sufficient. However, the more sample collected, the more sample screening and laboratory analysis can be performed.

- Carefully and firmly close the container, using short-range gentle motions. Gentle motions reduce the potential for contaminant volatilization and prevent a powdery substance from becoming airborne and spreading contamination.

- Remove any debris from the outside of the container using 10% bleach solution or a bleach wipe, and retain the wiping material in a plastic bag. Wrap Parafilm™ wax paper around the seam of the container and lid, sealing the sample from contamination or leakage.

- Place a custody seal over the container and Parafilm™ wax paper such that the seal is perpendicular to the seam of the container and its lid.

- Use a permanent marker to record the date and time of sample collection, sample identification, sample location, and any other pertinent information on the container and appropriate sample documentation (e.g., sample logbook, sample collection form, etc.). Place each container containing a biological sample into a clean self-sealing bag. Decontaminate bags and sample containers with disinfecting solution.

- Place some packing material into the outer plastic container or bag, and place the primary sample container(s) into the outer container so that they are protected from damage during transport.

- Close the outer container or bag and wipe the entire outside with disposable bleach wipes.

- Place another sample label on the outer container or bag if the original sample label is not clearly visible.

- Complete a sample report prior to sample shipment. An example sample report form is provided in Attachment A, Figure A-1. A copy of the sample report should be maintained with sample collection and site records and a copy should accompany the samples to the All Hazards Receipt Facility or laboratory. Follow the sample packaging and shipment instructions in Section 7.

6.1.3 Sample collection using wipe or swab

Chemical contaminants should be collected with cotton wipes or swabs and then placed in a glass certified clean container. Biological samples should be sampled with moistened non-cotton wipes or swabs and then placed in a sterile container. Swabs and wipes for biological samples can be moistened with sterile saline, phosphate buffered solution (PBS), or water. Swabs and wipes for chemical samples can be moistened with contaminant free water or other analytical method-prescribed solution. For hydrophobic materials, moistened wipes or swabs will repel the powder or film. For this reason, if the contaminant is unknown, it may be prudent to first attempt to collect material using a dry swab or wipe.

- Put on clean, sterile, powder-free latex, nitrile, or vinyl examination gloves and other required PPE prior to sampling.

- Prepare a diagram of the area(s) to be sampled, along with the locations of key surfaces. Place the diagram flat in a gallon-sized zipper bag and seal. Information locating the sampling areas can be written on the surface of the plastic bag with a permanent marker.

- Use a swab (for small or porous surfaces) or wipe (for large, non-porous surfaces) to collect samples from surfaces or objects. Wipe a maximum of 100-cm^2 surface area using each swab or wipe. Collect multiple wipe or swab samples as needed to collect a representative amount of sample. The wiped area should be equal for each wipe or swab collected, and the area recorded in cm^2 on the COC and other field forms.

- After sample collection and prior to removal from the contamination site, place the swab or wipe into a sterile conical tube (for suspected biological contaminants) or clean container (for suspected chemical contaminants).

- Carefully and firmly close the container, using short-range gentle motions. Gentle motions reduce the potential for contaminant volatilization and prevent a powdery substance from becoming airborne and spreading contamination.

- Remove any debris from the outside of the container using 10% bleach solution or a bleach wipe, and retain the wiping material in a plastic bag. Wrap Parafilm™ wax paper around the seam of the container and lid, sealing the sample from contamination or leakage.

- Place a custody seal over the container and Parafilm™ wax paper such that the seal is perpendicular to the seam of the container and its lid.

- Use a permanent marker to record the date and time of sample collection, sample identification, sample location, and any other pertinent information on the container and appropriate sample documentation (e.g., sample logbook, sample collection form, etc.). Place each container containing a biological sample into a clean self-sealing bag. Decontaminate bags and sample containers with disinfecting solution.

- Place some packing material into the outer plastic container or bag, and place the primary sample container(s) into the outer container so that they are protected from damage during transport.

- Close the outer container and wipe the entire outside of the container with disposable bleach wipes.

- Place another sample label on the outer container or bag if the original sample label is not clearly visible.

- Complete a sample report prior to sample shipment. An example sample report form is provided in Attachment A, Figure A-1. A copy of the sample report should be maintained with sample collection and site records and a copy should accompany the samples to the All Hazards Receipt Facility or laboratory. Follow the sample packaging and shipment instructions in Section 7.

6.2 Collection of Non-Aqueous Liquid Samples

This scenario describes the collection of unknown non-aqueous liquids that may be pooled on surfaces, contained in drums, or in direct contact with aqueous or solid matrices. The procedures described assume that biological contaminants will not be present in non-aqueous liquid matrices. If it is suspected that biological contamination has occurred, and that aqueous matrices will be collected into a non-aqueous liquid sample, these procedures should be performed using sterile equipment and containers. If a small amount of liquid is available for sampling or the liquid is difficult to access, a syringe can be used to remove the liquid into a sample container. Glass tube samplers can be used to collect samples from deep pools or inside containers such as drums, and are useful in determining the presence of multiple layers. Grab samples also can be collected directly into suitable sample containers. A description of the liquids collected should be recorded on the field report form.

6.2.1 Equipment needed

- Clean, disposable nitrile gloves (at least two pair per individual)
- Contaminant free syringes and blunt tip needles
- Contaminant free Teflon® tubing and tubing weights
- Glass sampling tube – typically 122 cm long with a 6 to 16 mm inside diameter. Larger diameter tubes may be used for viscous fluids if sampling with the small diameter tube is not adequate.
- Containers for suspected chemical contaminants – certified clean, four ounce or larger glass containers with Teflon®-lined top (~60 mL for syringe sampling)
- Plastic outer container, large enough to hold glass containers used to collect samples for chemical compounds (typically 8 or 16 ounce wide mouth container is sufficient)
- Quart-sized self-sealing plastic bags
- Sealing tape or Parafilm™
- Transport container – large plastic container (e.g., cooler) capable of holding primary sample container(s) and packing materials, including ice
- Absorbent material for packing (e.g., antiseptic bandage pads or non-cotton cloth)
- Individually wrapped disposable bleach wipes
- Potable water – for immediate removal of any contaminated materials from skin, eyes, or other surfaces

6.2.2 Sample collection using a syringe

Collection of liquid samples using a syringe is best when there is a limited amount of sample available for collection or when the liquid is contained in a small puddle or cracks within a surface. Extension tubing can be attached to the syringe if the sample is difficult to reach. Weighted tubing can be inserted into a liquid and sampled at a discrete depth if desired. Tubing is also useful for sampling a liquid that is on the other side of a grate or manhole from the sampler.

- Put on clean, powder-free latex, nitrile, or vinyl examination gloves and other required PPE prior to sampling.

- To the extent possible, syringes should be prepared outside the contamination area, prior to sample collection. Attach the blunt tip needle to the syringe. If tubing is necessary, cut the length of tubing needed and attach the tubing to the blunt tip of the syringe. Attach a weight to the tubing if the tubing need to be submerged or if the tubing needs to be lowered several feet to reach the sample. Proper handling and disposal of the syringe and blunt needle should be practiced. Inadvertent injection is possible with any syringe. All needles should be stored and disposed of in a sealed container that is properly labeled.

- Insert the tip of the syringe or tubing into the liquid and pull the syringe plunger to draw the sample into the syringe. Continue to collect sample until either the syringe is full or as much of the sample as possible has been drawn into the syringe. If the substance is reasonably pure, a few grams of material should be sufficient. However, the more sample collected, the more flexibility the laboratory will have in sample analysis.

- Slowly inject the contents of the syringe into a sample container. Ensure the vortex caused in minimal to prevent volatilization.

- If there is sufficient sample quantity, repeat the syringe draws using the same syringe until the container is filled.

- Carefully and firmly close the container, using short-range gentle motions to reduce the potential for contaminant volatilization and prevent spillage. Seal the top of the container with Parafilm™ wax paper.

- Remove any debris from the outside of the container using 10% bleach solution or a bleach wipe, and retain the wiping material in a plastic bag. Wrap Parafilm™ wax paper around the seam of the container and lid, sealing the sample from contamination or leakage.

- Place a custody seal over the container and Parafilm™ wax paper such that the seal is perpendicular to the seam of the container and its lid.

- Use a permanent marker to record the date and time of sample collection, sample identification, sample location, and any other pertinent information on the container and appropriate sample documentation (e.g., sample logbook, sample collection form, etc.). Place each container containing a biological sample into a clean self-sealing bag. Decontaminate bags and sample containers with disinfecting solution.

- Place some packing material into the outer plastic container or bag, and place the primary sample container(s) into the outer container so that they are protected from damage during transport.

- Close the outer container and wipe the entire outside of the container with disposable bleach wipes.

- Place another sample label on the outer container or bag if the original sample label is not clearly visible.

- Complete a sample report prior to sample shipment. An example sample report form is provided in Attachment A, Figure A-1. A copy of the sample report should be maintained with sample collection and site records and a copy should accompany the samples to the All Hazards Receipt Facility or laboratory. Follow the sample packaging and shipment instructions in Section 7.

6.2.3 Sample collection using a glass tube

Glass tube sampling was originally designed for use in removing liquids from 55-gallon drums, and is useful in cases where the sampler is unsure whether there are multiple liquids present or in cases where the liquid is pooled in a deep container or crevice. In some cases, two or more liquid layers may be present, and a glass tube sampler enables sample collectors to determine the number and location of liquid layers. In cases where multiple liquid layers are present, either a glass tube or syringe can be used to collect samples of the individual layers. It is recommended that use of glass tubes for sample collection be performed with a two-person sampling team.

- Put on clean, powder-free latex, nitrile, or vinyl examination gloves and other required PPE prior to sampling.

- Slowly insert the glass tubing to just above the bottom of the body of liquid. *Note*: Ideally, the tubing used should be of sufficient length so that at least 30 cm extend above the top of the liquid.) Allow the liquid to reach its natural level in the tube. Cap the top of the tube with a safety-gloved thumb or a stopper, and carefully remove the capped tube from the liquid. If the tube has passed through more than one layer of liquid, the boundary should be apparent in the glass tube. If more than one type of liquid is present, one sample should be collected from each liquid layer. Close inspection is required as liquids often are clear but have different densities.

- Determine whether samples can be collected using a syringe or glass tube. If using a syringe, follow the procedure described in Section 6.2.2. Separate syringes must be used for each layer of liquid and extension tubing must be cut to lengths sufficient to collect sample from each layer.

- If using a glass tube, collect sample from each layer as described above, and insert the bottom of the tube into an uncapped sample container. Partially release the stopper or thumb and allow the sample to slowly flow into the sample container.

- To ensure that sample containers contain only the liquid from each layer, cap off tube before a liquid layer has completely emptied into the sampling container. Empty the liquid on either side of each layer boundary into a separate waste container.

- Repeat this action until a sample from each liquid phase is collected. If multiple phases are present, make sure to note the approximate depth ranges of the phases. Once each liquid phase is in a sample container, firmly cap and close the sample container(s), and seal the top of the container(s) with Parafilm™ wax paper.

- Close the outer container and wipe the entire outside of the container with disposable bleach wipes.

- Place a custody seal over the container and Parafilm™ wax paper such that the seal is perpendicular to the seam of the container and its lid.

- Use a permanent marker to record the date and time of sample collection, sample identification, sample location, and any other pertinent information on the container and appropriate sample documentation (e.g., sample logbook, sample collection form, etc.). Place each container containing a biological sample into a clean self-sealing bag. Decontaminate bags and sample containers with disinfecting solution.

- Place some packing material into the outer plastic container or bag, and place the primary sample container(s) into the outer container so that they are protected from damage during transport.

- Close the outer container and wipe the entire outside of the container with disposable bleach wipes.

- Place another sample label on the outer container or bag if the original sample label is not clearly visible.

- Complete a sample report prior to sample shipment. An example sample report form is provided in Attachment A, Figure A-1. A copy of the sample report should be maintained with sample collection and site records and a copy should accompany the samples to the All Hazards Receipt Facility or laboratory. Follow the sample packaging and shipment instructions in Section 7.

6.3 Collection of Aqueous Samples

This scenario includes collecting chemical and biological unknown contaminants contained in aqueous matrices such as reservoirs that feed a drinking water system or other water distribution components. Grab samples should be collected when water samples are suspected to contain high levels of bacteria and/or particulates. If the contaminant or contaminant class is unknown, it may be necessary to provide the analytical laboratory with a complete set of containers for chemical and biological analysis (see Tables 3-1through 3-3). This requires almost 20 liters of sample for the chemical analyses and over 100 liters for the biological analyses. Because biological contaminants present in water systems are likely to be dilute, large volumes of sample are often needed. In these cases, samplers should collect large volumes of water for concentration in the laboratory.

The difficulty of confirming the presence/absence of a biological contaminant in a water source is that a biological warfare agent can be very diluted in a large amount of water and yet still be dangerous. A large amount of sample is required in order to thoroughly analyze the sample for biological agents. The large quantity of water needs to be concentrated for analysis using a filter and pump apparatus that concentrates viruses, bacteria, and protozoa onto a filter. Ultrafiltration will filter over 100 liters of water and result in a 250-mL concentrated sample. Because sample concentration using membrane filtration or ultrafiltration should be performed by a trained professional, it is highly recommended that these processes be performed at the laboratory.

6.3.1 Equipment

- Clean, disposable nitrile gloves (at least two pairs per individual)
- Containers for suspected chemical contaminants – certified clean (See Tables 3-1 through 3-3)
- Sampling pole (e.g., aluminum fixed or telescoping pole attached to the sample container)
- Water sampling device (e.g., weighted bottle samplers)
- Containers for suspected biological contaminants – sterile. See Tables 3-1 through 3-3)
- Plastic outer container, large enough to hold glass containers used to collect samples for chemical compounds (typically 8 or 16 ounce wide mouth container is sufficient)
- Quart-sized self-sealing plastic bags
- Sealing tape or Parafilm™
- Transport container – large plastic container (e.g., cooler) capable of holding primary sample container(s) and packing materials, including ice
- Absorbent material for packing (e.g., antiseptic bandage pads or non-cotton cloth)
- Individually wrapped disposable bleach wipes
- Potable water – for immediate removal of any contaminated materials from skin, eyes, or other surfaces

6.3.2 Collection of grab samples

- Put on clean, powder-free latex, nitrile, or vinyl examination gloves and other required PPE prior to sampling.

- If sampling from a spigot or other sampling port with a tap, fill the containers directly from the tap. All hosing or tubing should be removed from the tap prior to collection. If possible, let the water run before sampling so that the sample collected is representative of the main body of water rather than the water in the pipes. Technically, three to five times the volume of the piping from the main body of water to the spigot should be discarded, but sometimes field conditions do not allow this. This water should be collected and not allowed to flow openly or into a drain discharge.

- Surface water samples are collected manually by submerging a clean or sterile container into the water body. Remove the lid and protect it from contamination. Grasp the container at the base with one hand and plunge the container mouth down into the water to avoid introducing surface scum. If the sample source cannot be easily reached, use a sampling pole to plunge the container below the surface. If there is a current, position the mouth of the bottle into the

current. Ideally, the sampling depth should be 15-30 cm (6"-12") below the water surface. If the water body is static, an artificial current can be created by moving the bottle horizontally in the direction it is pointed and away from the sampler.

- Samples may be collected at depth with a covered bottle that can be removed with a tripline. The most common sampler types are beakers, sealable bottles and jars, pond samplers and weighted bottle samplers. Pond samplers have a fixed or telescoping pole attached to the sample container. Weighted bottle samplers are lowered below the water surface, where the attached bottle is opened, allowed to fill and pulled out of the water. When retrieved, the bottle is tightly capped and removed from the sampler assembly. Specific types of weighted bottle samplers include Kemmerer or Van Dorn.

- Containers used to collect samples for measurement of volatile compounds should be completely filled. Completely fill containers, allowing for zero head space, by slowly filling the container to just before overflowing. Once a water dome appears at the container top, close and tightly secure the cap. Invert the container or vial upside down to make sure there is no air bubble present.

- Plastic, amber glass, and sterile containers should be filled to the top allowing ½-inch head space. The sampler will add preservation to appropriate containers as indicated in Table 3-3 and then check the preservation. The sampler will close the container, invert the contents, then remove the lid, touch a piece of proper range pH paper to the lid and note the change in color. If the paper indicates proper preservation, the sampler will secure the lid and proceed. If additional preservation is required, it will be added and the container checked again. Firmly tighten caps on all containers after preservatives have been added.

- If a water sampling device is being used, it is recommended that one sampler operate the collection device while a second sampler holds and fills the sample containers. The sampler holding the containers will also apply the Parafilm™ wax paper and custody seals.

- If it is suspected that chlorine residual is present in samples collected for biological contaminants, dechlorinate the samples using sodium thiosulfate solution. Ideally, sample containers used for collection of biological contaminants will contain sodium thiosulfate dechlorinating solution prior to sample collection.

- Once all the samples have been collected, seal the tops of the containers with Parafilm™ wax paper. Place custody seals over the container and Parafilm™ wax paper such that the seal is perpendicular to the seam of the container and its lid.

Note: When many sample containers are necessary, it is often more practical to pack all of the sample containers into an overpack (usually a cooler or similar water proof container). Once these containers are all packaged correctly with ice (see Section 7), two custody seals can be placed on the overpack, rather than each sample. The drawback to doing this is that the containers must not leave the samplers' custody until they are packed into the cooler.

- Use a permanent marker to record the date and time of sample collection, sample identification, sample location, and any other pertinent information on the container and appropriate sample documentation (e.g., sample logbook, sample collection form, etc.). Place each container containing a biological sample into a clean self-sealing bag. Decontaminate bags and sample containers with disinfecting solution.

- Place some packing material into the outer plastic container or bag, and place the primary sample container(s) into the outer container so that they are protected from damage during transport.

- Close the outer container and wipe the entire outside of the container with disposable bleach wipes.

- Place another sample label on the outer container or bag if the original sample label is not clearly visible.

- Complete a sample report prior to sample shipment. An example sample report form is provided in Attachment A, Figure A-1. A copy of the sample report should be maintained with sample collection and site records and a copy should accompany the samples to the All Hazards Receipt Facility or laboratory. Follow the sample packaging and shipment instructions in Section 7.

6.4 Collection of Air Samples

Air sampling should be conducted as soon as possible after a contamination event because dispersion and dilution into the environment occurs at a greater rate than other matrices. Air sampling equipment is widely varied depending on location, analytical parameters, analytical equipment and sampler technique. If a contaminant or contaminant class is known, sample collectors should refer to existing corresponding analytical methods to determine the appropriate equipment to use.

Air is the most difficult environmental matrix from which to collect samples, because compound concentrations can be affected by numerous, varying, and uncontrollable factors (e.g., temperature, air currents, drafts or wind gusts, thermal effects, contamination). Contaminants also are typically present at low concentrations. The requirements and procedures used for collection of air sampling are generally complex, and are specific to the target contaminants and analytical methods that will be used to measure the contaminants. For this reason, only summary information and references are provided in this document. For specific procedures, please refer to the appropriate analytical methods, established regulatory procedures, equipment manufacturers' operating procedures, or the references provided.

Contaminants in air exist in either a gas or particulate (liquid or solid) phase. The objective of air sampling is to transfer a contaminant from a known or measured volume of air into an analytical instrument. In all cases, measurement of the volume of air collected or passed through concentration media is critical. Because contaminant concentrations are generally low, contaminants often must be concentrated using filters for particulates or sorbent materials for gases. Useful summary information regarding the advantages, disadvantages, and use of numerous air sample collection procedures, including the following typically used procedures, is included in the *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*, NAVSEA TO300-AZ-PRO-010:

- Whole air samples – collected into a bag, jar, canister, glass globe

- Concentrated samples – collected using passive sampling badges, active air samplers (i.e., high-flow or low-flow pumps), or solid sorbents (large volumes of air are passed through a series of adsorbing cartridges)

- Particulates – collected using filtration, impactors, or impingers

Additional information and guidance regarding collection of air samples can be found in:

- National Institute of Safety and Health (NIOSH) *Manual of Analytical Methods*, 4th Edition. DHHS (NIOSH) Publication 94-113 (August 1994), 1st Supplement Publication 96-135, 2nd Supplement Publication 98-119, 3rd Supplement 2003-154.

- Tetra Tech EM Inc., prepared for USEPA Region 5 Emergency Response Branch. "Biological Agent Sampling Guidelines and Analytical Approach for Regional Counterterrorism Response Plans." August 5, 2003.

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), Sampling and Analytical Methods.

- U.S. Environmental Protection Agency Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.

- U.S. Navy. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. NAVSEA T0300-AZ-PRO-010.

Section 7.0
Sample Packaging and Shipment

The following information provides guidelines for proper packaging, labeling and shipping of unknown sample containers. This information reflects current regulations from the Code of Federal Regulations, EPA documents, and DOT information sources. Additional information and applicability can be obtained from common carriers' Hazardous Material Center hotlines.

7.1 Unknown Environmental Samples - Chemical and Biological

This section describes the procedures for properly packaging and shipping unknown contaminants contained in environmental samples collected from a contaminated site. These procedures will be performed after all samples have been collected and placed in the proper containers, and sealed in containment bags. The U.S. Environmental Protection Agency does not generally regulate biologically active substances or wastes. Biohazards should be communicated through labeling and biohazards signs. Where biologically active substances and wastes are used, handled or stored, sampling personnel should use the universal biohazard symbol.

7.1.1 Packaging

- Samples requiring cooling as a preservative should be placed in a cooler/overpack with ice immediately to assure sample temperature does not exceed preservation requirements until analysis is performed. *Note:* Do not allow samples to freeze during on-site storage or shipment. Neither dry ice nor "blue ice" is capable of maintaining the sample aliquots in coolers at the required temperature for the average transit time. Use only regular ice for cooling during sample shipment. For this reason, dry ice should not be used for cooling during shipment.

- Each containment bag should be securely wrapped with bubble-wrap.

- A picnic type cooler or overpack can be used as a shipping container. Only hard plastic, impact resistant coolers in good condition should be used. Coolers should be well packed to prevent container movement during shipping. In preparation for shipping samples, if present, the drain plug, is taped shut from the inside and outside, and a large, new, clean plastic bag is used as a liner for the cooler. Approximately three inches of inert packing material, such as vermiculite, perlite, or Styrofoam "peanuts," is placed on the bottom of the liner.

- Sample containers are placed upright in the lined cooler in such a way that they do not touch and will not touch during shipment. Place bubble-wrap, or other suitable material that will retain its integrity if it gets wet, between each sample bag to take up any void space and to prevent the containers from touching. Place a temperature blank, if available, in close proximity to the samples.

- As required, samples should be shipped to the laboratory on ice and chilled to 4˚C±2˚C. Place ice inside Ziplock bags. Place each bag of ice inside a second Ziplock bag. Place the bagged ice around, among, and on top of the sample bottles to assure samples will arrive at the laboratory or screening facility at 4˚C±2˚C. The liner bag is then secured with a twist-tie or knot.

- The paperwork (e.g., original copy of COC) going to the laboratory is placed inside a plastic bag. The bag is sealed and taped to the inside of the cooler lid. The last block of the COC form should indicate the overnight carrier and the associated air bill number. A copy of the COC is retained with the project document files. The air bill must be filled out before the samples are handed over to the carrier.

- The cooler is closed and taped shut with strapping tape (filament-type) by running the tape around both ends of the cooler at least two times. Do not use standard plastic shipping tape.

- At least two signed custody seals are placed on the cooler, one on the front and one on the side, to maintain the integrity of the sample custody process.

- A copy of the COC and the air bill should be faxed to the laboratory to assist in tracking of potentially mis-routed coolers.

7.1.2 Shipping

Samples, by federal law, may be transported only by authorized carriers. Government specified carriers may be used. FedEx and United Parcel Service are typical authorized carriers. The U.S. Postal Service will NOT ship environmental samples. The sample cooler is handed over to an authorized overnight carrier. A standard air bill is necessary for environmental samples. The air bill is affixed to the top of the cooler and should contain both the shipped-from and ship-to address. The shipper's copy of the air bill is retained with project document files as evidence. The laboratory or receiving facility will document the carrier information upon receipt.

7.2 Hazardous Chemical Shipment (49 CFR 171-180)

If the sample has a known hazardous component, it must be packaged and shipped utilizing the requirements at 49 CFR 173.24 and 173.24a. The type of container, correct labeling, proper naming of the hazardous material, proper labeling and transportation type are required.

7.2.1 Packaging

For containers, you should:

- Use a container made of, or lined with, a material that is compatible with the hazardous waste to be stored. (This will prevent the waste from reacting with or corroding the container.)

- Samples should be packed with enough absorbent material to absorb twice the amount of liquid contained in the package.

- Keep all containers holding hazardous waste closed during storage, except when adding or removing waste. Do not open, handle, or store (stack) containers in a way that might rupture them, cause them to leak, or otherwise fail.

- Maintain the COC as required with the sample container during shipment.

- A manifest document might be required and should accompany the shipment.

7.2.2 Shipping

All containers and outside containers must contain labeling corresponding to the particular hazard class as follows:

- Class 1 (Explosives)
- Class 2 (Flammable and Nonflammable Gas)
- Class 3 (Flammable Liquid)
- Class 4 (Solids)
- Class 5 (Oxidizers and Organic Peroxides)
- Class 6 (Poison)
- Class 7 (Radioactive)
- Class 8 (Corrosives)
- Class 9 (Miscellaneous)

All packages that contain DOT Hazardous Materials must be labeled in accordance with 49 CFR 172.400 requirements. This labeling requirement applies both to the sample containers that contain hazardous materials and to the shipping container in which the sample containers are packed.

Most HAZMAT teams licensed to transport hazardous materials have their own requirements for labeling packages. These may include such things as:

- Shipper's address
- Recipients's address
- Proper shipping name as designated by the U.S. Department of Transportation (DOT)
- The sample description must be exactly as written in the Hazardous Materials Table (HMT) at 49 CFR 172.101. Abbreviations may not be used unless specifically authorized or required by the DOT regulations. The sample description of a hazardous material must be identified by the entry of an "X" placed before the proper shipping name in the column captioned "HM." The "X" may be replaced by "RQ," if appropriate (i.e., Class 9).
- The UN/NA Identification Number

The following labeling is required:

- Proper shipping name and identification number from Column 4 of the HMT at 49 CFR 172.101.

- DOT shipping label, at least 3.9 inches on a side. Contact shipping company or DOT for instructions for labels of hazardous materials.

  Note: All containers of 110 gallons or less used in transportation should be marked with: "HAZARDOUS WASTE - Federal law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency." The laboratory's name, number and the identification number, as shown on the chain of custody form, should also be included.

> *Note:* The only materials for which you need not determine the actual hazard prior to selecting a proper shipping description are materials listed in the HMT at 49 CFR 172.101 with a "+" in column 1 [49 CFR 172.101 (b)(1)]. This notation fixes the proper shipping name and hazard class, regardless of the hazard presented. Also, specific materials listed as "Class 9," and which present no higher hazard, are always Class 9 [49 CFR 173.140].

Most small businesses use a commercial transporter to ship hazardous waste. These transporters can give advice on specific requirements for placarding, labeling, marking, and packaging; however, the sample owner remains responsible for compliance. For additional regulations (49 CFR Parts 172 and 173), call the DOT hazardous materials information line at (202) 366-4488.

Note: Federal regulations allow you to transport your own hazardous waste to designated TSDF (Treatment, Storage, or Disposal Facility) provided that you comply with DOT rules. Some states, however, do not allow this practice. Call DOT and your state hazardous waste management agency regarding applicable regulations.

Section 8.0
References and Additional Resources

1) Argonne National Laboratory, Environmental Assessment Division, prepared for USDOE. "Background Chemistry for Chemical Warfare Agents and Decontamination Processes in the Support of Delisting Waste Streams at the U.S. Army Dugway Proving Ground, Utah." April 1996.

2) Center for Disease Control "Safety Survival Skills II.. Laboratory Safety: A Primer on Safe Laboratory Practice and Emergency Response for CDC Workers," CDC, (pg. 31 - 40), Atlanta, GA, October, 2004.

3) Conti Environmental, Inc. and CH2M HILL, Inc. prepared for the US Army Corps of Engineers Kansas City District. "Final Sampling and Analysis Plan Remedial Action Chemical Insecticide Corporation Superfund Site Edison Township, Middlesex County, New Jersey." June 2003.

4) CSI, US Department of Justice Office of Justice Programs, January 2000.

5) Eastern Research Group, Inc., prepared for USEPA Office of Research and Development National Risk Management Research Laboratory. "Report on the Homeland Security Workshop on Transport and Disposal of Wastes from Facilities Contaminated with Chemical or Biological Agents." EPA/600/R-04/065 November 2003.

6) Electronic Code of Federal Regulations (e-CFR), Title 40: Protection of Environment, "Part 243: Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste." (http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6fd205ef7b5ad1e351ab81b7ad497440&rgn=div5&view=text&node=40:24.0.1.4.31&idno=40)

7) Electronic Code of Federal Regulations (e-CFR), Title 49: Transportation, (http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=ec87000b853a02ac65fb64e6ba2e4c78&c=ecfr&tpl=%2Findex.tpl)

8) ER 1110-1-263: Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities,

9) Federal Bureau of Investigation, Handbook of Forensic Services, 2003 (http://www.fbi.gov/hq/lab/handbook/forensics.pdf),

10) FedEx (http://www.fedex.com), Hazardous-Materials Shipping.

11) Laboratory Safety Supply Inc. "Domestic Preparedness and Response a Guide for First Responders," Spring 2005 Catalog.

12) LSS, Domestic Preparedness & Response Product Offering Catalogue, Spring 2005.

13) National Center for Biomedical Research and Training, Academy of Counter-Terror Education, Louisiana State University and Agricultural & Mechanical College. "Public Safety WMC Response - Sampling Techniques and Guidelines Participant Manual." Work in Progress Version 1.0.

14) Occupational Safety and Health Administration regulations at 29 CFR 1910.120 or 29 CFR 1926.65: *Hazardous Waste Operations and Emergency Response*.

15) QuickSilver Analytics, Inc. "FAC® Model QSA 102 Chem-Bio Sampling Kit Classroom Power Point Presentation." Revision 2.0, July 2004.

16) QuickSilver Analytics, Inc. "Products and Services 2004 Catalog."

17) Tetra Tech EM Inc., prepared for USEPA Region 5 Emergency Response Branch. "Biological Agent Sampling Guidelines and Analytical Approach for Regional Counterterrorism Response Plans." August 5, 2003.

18) U.S. Army Chemical Research and Development Center. "Environmental Hazards of Chemical Agent Stimulants," 1984.

19) U.S. Army. Department of the Army. Army Regulation 50-6. "Nuclear and Chemical Weapons and Materiel Chemical Surety." June 26, 2001.

20) U.S. Department of the Army "Nuclear and Chemical Weapons and Material: Chemical Surety," Washington, DC, June 2001.

21) U.S. Department of the Army, Pamphlet 385-61, *Toxic Chemical Agent Safety Standards*, 27 March 2002.

22) U.S. Department of the Army, Pamphlet 40-8, *Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, BB, GD, and VX*, 4 December 1990.

23) U.S. Department of the Army, Pamphlet 40-173, *Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT*, 3 June 2003.

24) U.S. Department of the Navy "Navy Environmental Compliance Sampling and Field Testing Procedures Manual."

25) U.S. Environmental Protection Agency, Engineering And Analysis Division (EAD), Sampling Guide, June 1991.

26) U.S. Environmental Protection Agency, USEPA, Biological Agent Sampling Guidelines and Analytical Approach for Regional Counterterrorism Response Plans, August 2003.

27) U.S. Environmental Protection Agency, "Environmental Management Guide For Small Laboratories," USEPA, Washington, DC, May 2000.

28) U.S. Environmental Protection Agency, USEPA, Office of Criminal Enforcement, Forensics, and Training Environmental Crime Symposium (October 2001),

29) U.S. Environmental Protection Agency, "Understanding the Hazardous Waste Rules: A Handbook for Small Businesses," USEPA, Washington, DC, April 1996.

30) U.S. Environmental Protection Agency, USEPA, RCRA Waste Sampling Draft Technical Guidance, October 2001 (http://www.epa.gov/epaoswer/hazwaste/test/samp_guid.htm),

31) U.S. Environmental Protection Agency, USEPA, Response Protocol Toolbox: Planning For and Responding to Drinking Water Contamination Threats and Incidents (Module 3: Site Characterization and Sampling Guide), December 2003.

Appendix

Example Forms

Figure A-1: Example Sample Report Form

Identification of Site

Sample Identification Number(s):

Location of Sample Collection:

Sample Owner and/or Collector:

Date and Time of Collection:

Sample Description:

Sample Type

Surface Water	Soil/Sediment	Leachate
Ground Water	Sludge	Air
Potable Water	Waste	Other:
Wastewater	Powder	

Sample Physical State and Appearance:

Solid	Granular	Color:
Liquid	Powder	Other:
Gas	Oily	

Give the approximate sample amount (volume or weight) and what preservatives have been added:

Incident Details

Describe the number of people exposed and the types of symptoms they are experiencing:

Describe the event and reason for sample collection:

Identify the person(s) and Agencies that have been informed of the event:

Figure A-2: Example Field Testing Report Form

Identification of Site

Sample Identification Number(s):

Location of Sample Collection:

Sample Owner and/or Collector:

Date and Time of Collection:

Field Testing

Indicate Types of Field Test Performed at the Site:

Specific Chemical	Radioactive
Biological	Explosives Field Measurement
Other:	

Describe Container and/or Package Type:

Explain testing equipment used and the date and time testing was performed. Also include the results of the tests and who performed the tests.

Figure A-3: Example Photograph Log

Site Name and Location:			
Camera:	Video	If Nondigital:	Film Type
	Digital		Film Roll Number
	Nondigital		
Photo #	Date and Time		Location/Description

A-4: Example Chain of Custody Form

Sample Owner and Contact:	**Remarks:**
Site Name and Location:	

Sample Type		**Samplers (sign):**
1.Surface Water	7.Sludge	
2.Ground Water	8.Waste	
3.Potable Water	9.Air	
4.Wastewater	10.Powder	
5.Leachate	11.Other:	
6.Soil/Sediment		

Sample ID Number	**Sample Type**	**20__ Date**	**Time**	**Composite**	**Grab**	**Site Location/Description**			Field Biological Screen	Field Chemical Screen	Field Explosive Screen	Field Radiation Sc		

Relinquished By: (Print)	Date/Time	Received by: (Print)	Relinquished By: (Print)	Date/Time
Sign:		Sign:	Sign:	

10.6 Appendix F: References and Additional Resources

References:

United States. Department of Health and Human Services. Public Health Service. Centers for Disease Control. National Institute for Occupational Safety and Health. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. DHHS (NIOSH) 85-115. Washington: GPO, 1985.

---. Department of Labor. Occupational Safety and Health Administration. Hazardous waste operations and emergency response. 29 CFR, Part 1910, Section 120. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Hazardous waste operations and emergency response. 29 CFR, Part 1926, Section 65. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. Department of Transportation. Pipeline and Hazardous Materials Safety Administration. General information, regulations, and definitions. 49 CFR, Part 171. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Hazardous materials table, special provisions, hazardous materials communications, emergency response information, and training requirements. 49 CFR, Part 172. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Shippers general requirements for shipments and packagings. 49 CFR, Part 173. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Carriage by rail. 49 CFR, Part 174. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Carriage by aircraft. 49 CFR, Part 175. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Carriage by vessel. 49 CFR, Part 176. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Carriage by public highway. 49 CFR, Part 177. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. Environmental Protection Agency. EPA Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance. 5th ed. EPA 815-R-05-004. Washington: GPO, 2005.

Additional Resources:

American National Standards Institute. Radiation Protection Instrumentation Test and Calibration. ANSI N323A. Washington: ANSI, 1997.

ASTM International. Standard Test Methods for Flammability Potential Screening Analysis in Waste. ASTM D4982-95. Philadelphia: ASTM International, 2001.

---. Standard Test Method for Screening of Oxidizers in Waste. ASTM D4981-95. Philadelphia: ASTM International, 2003.

---. Standard Test Method for Screening of pH in Waste. ASTM D4980-89. Philadelphia: ASTM International, 2003.

Berkeley Nucleonics Corporation. SAM 935 Surveillance and Measurement System. Version 11. Sept. 2005.

Field Forensics Inc. EL100 Field Guide. For more information please email info@fieldforensics.com or call (727) 867-0673.

---. Model EL100 Operating Instructions. For more information please email info@fieldforensics.com or call (727) 867-0673.

Holzman, G., E. H. Smith, and Carl Niemann. The Colorimetric Estimation of H and HN3 with DB3. OSRD 4288. Washington: Office of Scientific Research and Development, 1944.

Ludlum Measurement, Inc. Ludlum Model 2360 Scaler/Ratemeter Data Logger. May 2006.

---. Ludlum Model 2929 Dual-Channel Scaler. Sept. 2001.

---. Ludlum Model 43-10-1 Alpha-Beta Sample Counter. Feb. 2002.

---. Ludlum Model 43-93 & 43-93-2 Alpha/Beta Scintillators. July 2002.

Mistral Group. "Drop-Ex Plus Instructions." Security, Law Enforcement and Public Safety. 22 Sept. 2006 <http://www.mistralgroup.com/SEC_downloads.asp>

National Fire Protection Association. Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies. NFPA 1991. Quincy: NFPA, 2005.

---. Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies. NFPA 1992. Quincy: NFPA, 2005.

RAE Systems, Inc. MultiRAE Plus User Manual. 008-4022-000. Revision B. Nov. 2003.

Smiths Detection Ltd. LCD 3.2 Enhance Lightweight Chemical Detector Operational Instructions/User Manual. July 2004.

United States. Department of the Army. Chemical Surety. AR 50-6. Washington: USAPA, 2001.

---. ---. Toxic Chemical Agent Safety Standards. DA PAM 385-61. Washington: USAPA, 2002.

---. ---. Center for Health Promotion and Preventive Medicine. The Medical NBC Battlebook. USACHPPM Tech Guide 244. Washington: USAPA, 1999.

---. Department of Health and Human Services. Public Health Service. Interstate shipment of etiologic agents. 42 CFR, Part 72. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Select agents and toxins. 42 CFR, Part 73. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

---. ---. ---. Centers for Disease Control and Prevention and National Institutes of Health. Biosafety in Microbiological and Biomedical Laboratories. 4th ed.

---. Department of Homeland Security. Interim National Infrastructure Protection Plan. Washington: GPO, 2005.

---. Nuclear Regulatory Commission. Standards for protection against radiation. 10 CFR, Part 20. e-CFR, GPO Access. 20 Sept. 2006 <http://ecfr.gpoaccess.gov>.

Radiation Measurement: Unit Conversions

MicroR (micro Roentgen) is a measurement of the intensity of gamma rays. It is not to be confused with microrem (μrem), a measurement of how damaging radiation is to tissue. For gamma radiation, one microR is roughly equal to 1 microrem. This is not the case for alpha and beta radiation.

For gamma radiation:
1 mrem (1 millirem) = 1,000 μrem (roughly equal to 1,000 microR)
1 mR (1 milliRoentgen) = 1,000 μR (roughly equal to 1,000 microrem)

NOTE: 1 mrem (1,000 μrem) is the amount of radiation a typical person with a normal lifestyle receives in a single day.